

NEOLITHIC ALEPOTRYPA CAVE

IN THE MANI, GREECE

IN HONOR OF
GEORGE PAPATHANASSOPOULOS



Anastasia Papathanasiou, William A. Parkinson,
Daniel J. Pullen, Michael L. Galaty, Panagiotis Karkanas

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Edited by

A. PAPATHANASIOU, W. A. PARKINSON, D. J. PULLEN,
M. L. GALATY, AND P. KARKANAS

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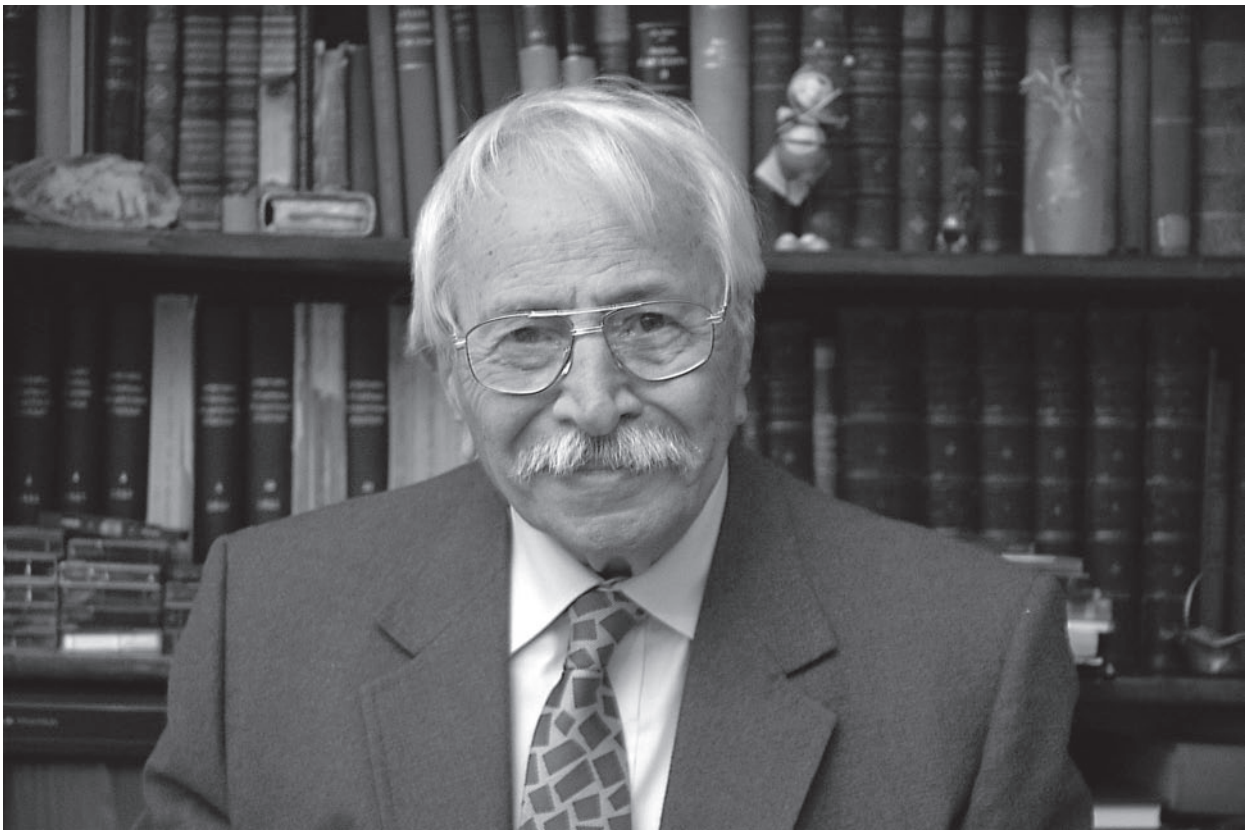
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Front cover: Alepotrypa Cave, the Lake (by Andreas Darlas)



George Papathanassopoulos

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List of contributors

MEIGHAN BOYD

Department of Earth Sciences, Royal Holloway,
University of London, UK.
Meighan.boyd@rhul.ac.uk

THOMAS CUCCHI

Archéozoologie, Archéobotanique: sociétés, pratiques,
environnements. UMR 7209 du CNRS, Muséum
National d'Histoire Naturelle, Paris, France.

MICHAEL L. GALATY

Director, Museum of Anthropological Archaeology, and
Professor, Department of Anthropology, University of
Michigan, Ann Arbor, MI, USA.
mgalaty@umich.edu

JULIA I. GIBLIN

Assistant Professor of Anthropology, Anthropology
Program, Quinnipiac University, Hamden, CT, USA.
Julia.giblin@quinnipiac.edu

ANGELOS HADJIKOUMIS

Research Technician and Demonstrator in
Zooarchaeology, Department of Archaeology,
University of Sheffield, Minalloy House, 10–16
Regent Street, Sheffield, S1 3NJ, UK.
a.hadjikoumis@sheffield.ac.uk

KARIN HOLMGREN

Swedish University of Agricultural Sciences,
Uppsala, Sweden.
karin.holmgren@slu.se

PANAGIOTIS KARKANAS

Director, Malcolm H. Wiener Laboratory for
Archaeological Science, American School of
Classical Studies Souidias 54, 106 76 Athens, Greece.
tkarkan@ascsa.edu.gr

STELLA KATSAROU

Ephorate of Paleanthropology and Speleology, Greek
Ministry of Culture, 34B Ardittou St.,
11636, Athens, Greece.
skatsarou@culture.gr

BARBARA KATSIPANOOU-MARGELI

Ephorate of Antiquities of Messinia Ventisi 22, 24100,
Kalamata, Greece.
barkats@otenet.gr

GEORGIA KOURTESSI-PHILIPPAKIS

Associate Professor of Prehistoric Archaeology,
Department of History and Archaeology, National
and Kapodistrian University of Athens/ School of
Philosophy, University Campus, Zografou, 157 84
Athens, Greece.
gkphil@arch.uoa.gr

WAYNE E. LEE

Dowd Distinguished Professor of History, University of
North Carolina – Chapel Hill, Chapel Hill, NC, USA.
welee@email.unc.edu

EVI MARGARITIS

Assistant Professor, Science and Technology for
Archaeology Research Center, The Cyprus Institute,
20 Kavafi Street, 2121 Nicosia, Cyprus.
evimargaritis@gmail.com

MARIA NTINOU

M.H.Wiener Laboratory for archaeological Science,
American School of Classical Studies Souidias 54,
106 76 Athens, Greece. “PlantCult” ERC_CoG,
Horizon 2020 Aristotle University of Thessaloniki,
54124 Thessaloniki, Greece.
maria.ntinou@uv.es

ANASTASIA PAPATHANASIOU

Ephorate of Paleoanthropology and Speleology, Greek Ministry of Culture, 34B Ardittou St., 11636, Athens, Greece.

anastasia.papathanasiou@gmail.com

KATERINA PAPAYIANNI

Malcolm H. Wiener Laboratory for Archaeological Science, American School of Classical Studies, Souidias 54, 106 76 Athens, Greece. katerinapapayiannis@gmail.com

WILLIAM A. PARKINSON

Curator of Anthropology, Field Museum of Natural History, Professor of Anthropology, University of Illinois at Chicago, Chicago, IL, USA.

wparkinson@fieldmuseum.org

ARETI PENTEDEKA

OREA Institute for Oriental and European Archaeology, Austrian Academy of Sciences, Hollandstrasse 11-13, 1020 Vienna, Austria & Laboratory of Prehistoric Archaeology, Department of Archaeology, Aristotle University of Thessaloniki, 541 24 Thessaloniki, Greece.

apentede@hist.auth.gr; areti510@yahoo.co.uk

AIKATERINI (KATERINA) PSIMOGIANNOU

Department of Anthropology, University of Illinois at Chicago, USA.

apsimo2@uic.edu

DANIEL J. PULLEN

Professor and Chairman, Department of Classics, Florida State University, Tallahassee, FL, USA.

dpullen@fsu.edu

DANIELLE J. RIEBE

Postdoctoral Fellow of Archaeological Chemistry The Field Museum of Natural History Chicago, IL, USA.

driebe@fieldmuseum.org

REBECCA M. SEIFRIED

Institute for Mediterranean Studies, Foundation for Research and Technology – Hellas, Rethymnon, Greece. rmseifried@gmail.com

GEORGIA STRATOULI

Greek Ministry of Culture Ephorate of Chalkidiki and Mount Athos Plateia Ippodromiou 7, 546 21 Thessaloniki, Greece. gstratouli@gmail.com

ANNA STROULIA

Adjunct Professor of Anthropology, Department of World Languages and Cultures, University of Southern Indiana, 8600 University Boulevard, Evansville, IN 47712, USA.

astroulia@usi.edu

TATIANA THEODOROPOULOU

Equipe de Protohistoire égéenne, CNRS-UMR 7041 Archéologies et Sciences de l'Antiquité, Nanterre, France.

tatheod@hotmail.com

GEORGIA TSARTSIDOU

a. Ephorate of Paleoanthropology and Speleology, Greek Ministry of Culture, 34B Ardittou St., 11636, Athens, Greece.

b. Malcolm H. Wiener Laboratory for Archaeological Science, ASCSA, Souidias 54, 106 76, Athens, Greece. gtsartsidou@ymail.com

GEORGE VALVIS

Ephorate of Paleoanthropology and Speleology, Greek Ministry of Culture, 34B Ardittou St., 11636, Athens, Greece.

gvalvis2@gmail.com

Memories of Alepotrypa Cave, Diros

George Papathanassopoulos

In 1970, the Hellenic Minister of the Interior for the military dictatorship, Stylianos Pattakos, removed me from my position as the Ephor of Antiquities at Olympia. He argued that the opening of the irrigation canal of the dam of the Pinios River, which was to be inaugurated by the head of the military junta, Georgios Papadopoulos, was being delayed due to my extensive excavations in the city of Ancient Elis. The canal was designed to pass through that region. I was unceremoniously removed from my position – while on leave in Athens – and reassigned to the Ephorate of Sparta, where I took office on 25 March 1970.

While in my new position, my interest was attracted to two small marble female figurines of Neolithic date that were displayed in a small case on the wall of the Archaeological Museum of Sparta. These figurines had been found by the speleologist Anna Petrocheilou in Alepotrypa Cave at Diros. I was further intrigued by other artefacts in the back yard of the museum: there were four big baskets full of fragments of broken jars with exceptional relief decoration. These had also been found at Alepotrypa Cave by Anna Petrocheilou. I took photographs of the fragments and recorded them. In addition to these extraordinary findings, in the official correspondence files of the Ephorate of Sparta, I saw references and descriptions with photographs and drawings of ten wall carvings that also had been observed by Anna Petrocheilou in various parts of the same cave system.

Understandably, my interest was piqued. I immediately planned a visit to the place of origin – Alepotrypa Cave at Diros. When I arrived there, I found a group of people, organised by the Philips Company, performing the final testing for the *Son et Lumière* installation. The programme was being organised by the Greek Organization of Tourism (EOT) as part of the forthcoming touristic attractions at the cave.

As a result of my visit, I realised that all ten wall carvings were fake. They had been etched recently at

various points throughout the cave, possibly by the same person that had previously produced ‘prehistoric centaurs’ on ‘ancient’ slate tiles and delivered them to the Museum of Volos, claiming them as originals.

I decided that I had to cancel the festive opening of Alepotrypa to tourism: the cave was full of archaeological material that had not been studied by the appropriate service.

Thus, after ten years of service at the National Archaeological Museum (1950–1960), followed by ten more at Ancient Olympia and after 1966 as Ephor of Antiquities. I began the third phase of my career as Ephor of Antiquities at Sparta where, from 1970 onwards, I was exclusively involved with the Neolithic Cave of Alepotrypa in Diros. When I entered Alepotrypa, knowing that the cave also had been used by Neolithic man, I could not help but feel strange – wondering about all the impressions and the feelings the cave had aroused in those people that had used it long ago, during the Neolithic period. Walking under the artificial light through the long corridor that winds to the back of the cave, to the lake with the potable water, I imagined a Neolithic man with just a torch in his hand following the same path I was taking. I thought that, just like me, he would have stopped – out of both respect and fear – at the point where the two corridors meet: where the higher level of Hall B descends to the significantly lower Ossuary of the Neolithic community. Then, continuing along the same path, he would have passed the cobbled ‘Niche of the Amphora’ (Niche 14) and entered Hall Z, where two neighbouring niches opened (Niches Z.22 and K.31) *en route* to the great hall of the cave, the Chamber of the Lakes.

The massive size of the cave and the incredible number of ceramic fragments found on the soil surface indicated to me that it was vital that systematic archaeological

research should be conducted here. So I asked for the collaboration of my colleague and friend Dimitris Theocharis, who was eminently skilled in the investigation of the Neolithic Age. Unfortunately, however, this was not possible due to serious obligations he had in Thessaly. So our collaboration was limited to just one visit at the very start of the archaeological investigations in the cave. The work began on 15 July 1970, with my colleague George Steinhauer, Curator of the Antiquities Ephorate of Sparta, the archaeologist Sophia Eleftheriadou and the experienced excavator Menelaus Paleologos of the Museum of Sparta.

At the beginning of the excavations in Alepotrypa, Spyridon Marinatos, who at the time was General Inspector, came to Alepotrypa accompanied by the French geologist Jean Marie Lambert of the mining operations at Laurion, with his wife Nicole. Marinatos assigned the study and further excavation of Ossuary II to them. Until then, the investigation had been carried out by myself and the biological anthropologist Aris Poulianos, who had also been brought in by Marinatos. The research started with the opening of trial trench B1 at the centre of Chamber B, where the greatest thickness of the undisturbed Neolithic human remains were, impressively, still visible.

Meanwhile, excavation across the whole of the Northern Sector of Chamber B had revealed the surface layer of the fill. As a result, we were able to locate *in situ* significant finds and furnishings established by the users of the cave in the later Neolithic Period. These included two deep circular storage pits lined with clay, similar to the one already revealed by Anna Petrocheilou at a higher level of the same chamber. One of these had a stone-lined rim, as well as a large hearth, and two intact ceramic vessels found *in situ*.

During the course of the excavation, I first lived in a small tent under the portico set up in front of the entrance of the cave; later I had the use of a camper, a kind courtesy of the EOT.

Amongst the general difficulties and vicissitudes of life that the excavation team in Diros had to endure was the lack of drinking water. We resorted to drinking the brackish water pumped from the cave's own lake. As for food, originally we had a roughly installed kitchen near the Chapel of St. Saviour. Later on, when the Ministry of Tourism's restaurant, located near the beach, began its service, we were able to eat there.

All the above-mentioned difficulties were rendered tolerable, however, by the natural beauty of the Gulf of Diros, with Mount Taygetos in the background.

For the safe daily transport of the excavation finds from the cave to the Museum of Sparta, upon my request, a car and a driver from the military unit of Sparta had been assigned to assist us. John Orfanakos, the Mayor of Pyrgos Dirou, Takis Kilakos, who later became Mayor, and local entrepreneurs Koulis

Kolokouris and Stavros Tsoukalas all were highly supportive of the project.

The examination of the top layer of the Northern Sector of Chamber B gave a good first impression of the conditions, lifestyle, and organisation of those Neolithic people that had used the cave. It seems that the inhabitants of the area and the cave would choose appropriate natural niches in its boundaries as places to reside; they opened circular pits with clay-lined walls and stone-lined rims – invariably of flat slabs of stones – to act as covers, presumably for the food stored therein.

This clear picture of their organized daily routine, particularly evident in the Northern Sector of Hall B and in Niche 15 of Chamber D (with its amphora *in situ*), spurred me on to pursue a general exploration of Alepotrypa. For this reason, I approached the pertinent Ministry Department and several other sponsoring bodies; I was successful in raising the finances for the project through the EOT and the Psychia Institution (1970–1971).

Unfortunately, the project was stopped in its tracks when I was held in Korydalos prison and suffered at the hands of the Junta for my political views. Even after my release, my persecution continued: first I became a *persona non grata* and then I was transferred to Agios Nikolaos in Crete, where I was eventually officially dismissed from my duties by a telegraph-message from the Junta.

After the regime change in 1974, I was legally returned to active service. First I served at the headquarters of the Ministry of Culture and then I was assigned to head up the newly-founded Department of Underwater Antiquities, a unit whose creation I had vigorously proposed. Here I served until January 1987, when I officially retired.

The period from 1970 to 1987 was a period of limited archaeological research in Diros but, over time, there was some significant development in the infrastructure. The existing portico was transformed into conservation laboratories, workshops, and a hostel where the excavation crew could live. All the necessities were provided: a kitchen, bathrooms, a study area, a conservation area, and a large storage room which later (1992) became the Diros Neolithic Museum. All this was successfully achieved with the help of the Association of Friends of the Neolithic Museum of Diros: in particular with the assistance of Carmen and Basilis Konstantakopoulos and the Greek-American couple Angelos and Eleni Tsakopoulos.

It must be emphasized that the project would never have succeeded without the dedication – well beyond their official obligations and responsibilities – of the scientific and technical staff who served and continue to do so from 1970 to the present day.

The excavation project at Alepotrypa Cave has led to more and more significant finds and continues to

hold my interest. In 1988 I broached the possibility of acquiring more substantial funding for additional research and development with the Minister of Culture, Melina Mercouri. By decision of the Minister, a programme for the project was agreed to with the Ministry of Culture, Archaeological Receipts Fund (TAPA) and the Municipality of Diros. The project was funded by grants from the TAPA. In this way, it became possible to recruit archaeologists, designers, administrators, and technical personnel.

The research included the continuation of the excavation in Trench B1: this yielded numerous finds – undecorated and painted pottery, rich skeletal material, figurines, and stone and bone tools. The progress was such that a depth of 5 m of excavation was reached: the stratigraphy of B1 revealed that Neolithic man was using Alepotrypa from c. 6,000 BC to 3,200 cal C.

In addition to trench B1, I began excavating in Niche Z22, just before the entrance to the Great Hall of the Lakes. In this area, numerous colourfully painted, broken, pots were revealed: this was an unexpectedly rich and unique cultural treasure. Apart from the archaeological value of these finds, the chance to see and handle them gave me – and even now continues to give me – joy beyond words, a deep satisfaction in that I was fortunate to have discovered them, and so to have ensured their preservation, promotion, and study.

With the Planning Agreement in place and the support of the Association of Friends of the Neolithic Museum

of Diros, the excavation and planning work in Diros has been decisively promoted and further advanced by the Archaeological Receipts Fund of the Ministry of Culture. During the summer of 2006 it finally became possible to allow the public to visit Alepotrypa: but only for 6 months as the funding soon came to an end.

However, I persevered in my efforts to advance the scientific work. In 2010, following a ministerial decision, I secured a 5-year programme, with the collaboration of Greek and US scientists and funding from the Institute for Aegean Prehistory, the Wiener-Laboratory, the Wenner-Gren Foundation for Anthropological Research, the National Geographic Society, and the Field Museum of Natural History.

After four decades, since 1970, Alepotrypa is now ranked as one of the most important archaeological sites of Neolithic culture in Europe. The book the site inspired me to write – *Neolithic Diros* – is included as teaching material in the Philosophical Schools of the Universities of Athens and Thessaloniki. I also feel delighted that my colleagues – Greek and foreign scientists of various disciplines – are busy with the study and publication of material acquired from Alepotrypa Cave.

I dream of the development of the infrastructure that Alepotrypa deserves and the building of a large museum nearby that will house and display all the major findings of the excavations. Thus, visitors will be best informed about the culturally sophisticated practices of Neolithic man on the southernmost tip of mainland Greece.

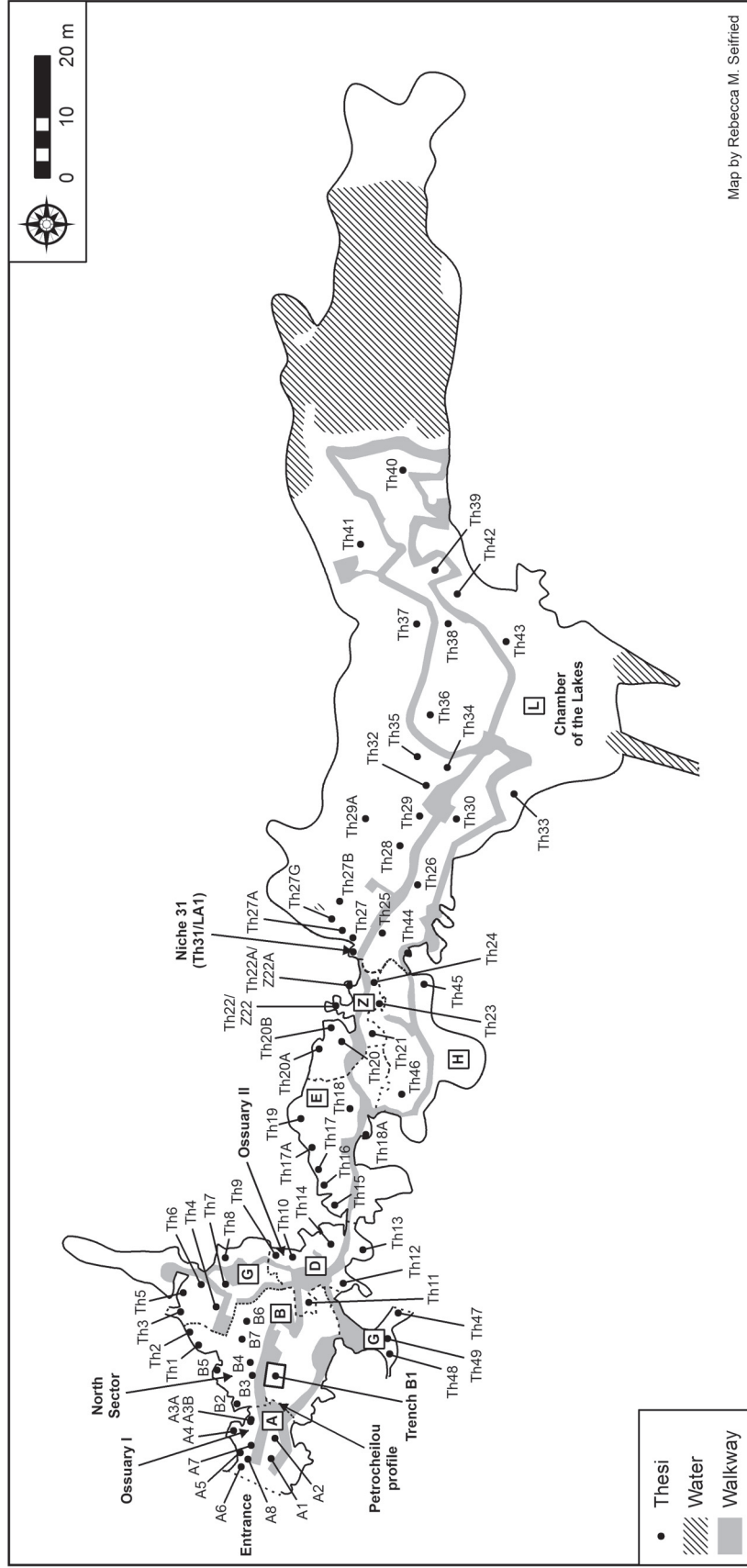


Figure 0.1. Alepotrypa Cave floorplan and archaeological loci. Important note: TH (from Thesi) is the equivalent of Θ ($\Theta\delta\sigma\eta$ = locus). TH can also be substituted for the chamber designation letter (i.e. Th/20 is the same as Θ /20 or Z/20). Certain loci may also bear specific names. Furthermore, Niche 31 is the same as LA1 or Th/31 or Θ /31.

Introduction

Anastasia Papathanasiou

The primary goal of this book is to offer a full scholarly and interdisciplinary study and interpretation of Neolithic Alepotrypa Cave's rich material and cultural record. The results will subsequently contribute to a better understanding of human behaviour and cultural evolution for the broader Neolithic by describing and interpreting aspects of change, continuity, ritual expression and material culture.

During the Neolithic Period existing patterns of human life, social organisation and economies profoundly changed to include domesticated plants and animals (with emphasis on a few taxa), a variety of technological developments, as well as an increasingly sedentary existence. Extensive research at numerous sites worldwide suggests that sedentism, agriculture, pastoralism, management of nature and, consequently, sociopolitical changes occurred at different rates and led to a variety of transformations in different parts of the world (Flannery 1973; Renfrew 1987; Bogucki 1996; Whittle 1996). In addition to the economic aspects, the process of Neolithisation triggered a series of changes in institutions and in cultural and social relations. As Whittle (1996, 8) states, 'if part of the process of becoming Neolithic was participation in new forms of social interaction, another part was a changing sense of belonging, of descent and of place in the scheme of things.' People reacted to the Neolithic material repertory in all sorts of ways and material combinations: 'one can enter the Neolithic for many reasons but as population changes, it changes your landscape of action, the economic choices you make ... and as the landscape of actions become restricted, people become increasingly committed to once optional choices,' (Robb 2014, 33).

Eventually and gradually, the effects of the Neolithic transformation have set the main directions for all subsequent prehistoric and historic cultural periods and have shaped who we are today. The Greek Neolithic

Period lasted from 6,800 BC to 3,200 BC (Coleman 1992; Andreou *et al.* 1996). Archaeological evidence for the Greek Neolithic is based mainly on Thessalian and Northern Greek open-air sites, either flat sites or tells, while evidence from Southern Greece is less abundant and rather under-represented. Therefore, a purpose of this volume is to contribute to filling this void, and to document, through a multidisciplinary approach, an extremely important and culturally rich site, aiming to define both its particularities and its position in the broader natural and cultural landscape.

The site of Alepotrypa Cave is located on Diros Bay, Lakonia, in Greece. It is a massive karstic formation of consecutive chambers, the last of which encompasses a lake of slightly brackish water. The cave was excavated by G. Papathanassopoulos from 1970 to 2006. Its occupation is dated from 6,000 to 3,200 cal BC and it was used in conjunction with the surrounding area as a complementary habitation area, burial site, and a place for ceremonial activity. This interpretation is suggested by a rich archaeological record that includes: primary and secondary burials, a variety of structures, such as hearths, clay-lined pits, and hard-packed clay floors, domesticated and wild animal remains, fish bones, marine shells, and botanical material, and a diverse ceramic assemblage of large storage vessels, as well as smaller plain or decorated ones, along with a massive quantity of deliberately fragmented fine pottery, chipped and ground stone tools, bone tools, weaving equipment, figurines, copper artefacts, and ornaments of shell, bone and stone.

As a sealed, single-component, archaeological site, the Neolithic settlement complex of Alepotrypa Cave is one of the richest of its period in Greece and Europe in terms of number of artefacts, preservation of biological materials, volume of undisturbed deposits, and horizontal extent of the exposed archaeological surfaces. Given the

abundance and the variability of the material culture, ritual expression, and temporal range of the site, this publication makes an important contribution to current archaeological research of the Neolithic Period in Greece in particular, but also in Anatolia, the Balkans and Europe in general, for a time period when evidence is limited. The results of the excavations in Alepotrypa Cave will prove crucial to subsequent archaeological research, in that they will establish regional artefact typologies, refine chronologies and yield information critical for understanding the material culture and the social organisation of later Neolithic societies in the Aegean and the Balkans.

However, to date, and after more than four decades of excavation, the publications on Alepotrypa consist only of several preliminary reports (Papathanassopoulos 1971, 1992, 1996a, 1996b, 1996c and Lambert 1972); specialised books and a paper in Greek (Papathanassopoulos 2011; Rammou 2009; and Karali 1998) and Phelps' presentation and discussion of a small part of the ceramic assemblage (1975, 2004). The human osteological remains and the mortuary practices have been published more extensively by Papathanasiou (1999, 2000, 2001, 2003, 2005, 2009, 2012). Thus, only a portion of the approximately 25,000 catalogued artefacts and the approximately 100,000 uncatalogued smaller fragments from the Alepotrypa Cave has been published systematically in an academic venue, resulting in the absence of a comprehensive chronological, stratigraphic and contextual presentation of the site leading to a deficit in its overall comprehension and even the drawing of erroneous interpretations about the site.

With primary support from the Levy Foundation, the artefact backlog from the 1970 to 2006 excavation seasons at Alepotrypa was studied and the results of approximately 40 years of excavation and analysis are published in this edited volume. This contribution is essential to current Neolithic research as it brings a unique site, one of the most important in Europe, to the attention of the archaeological community. Most crucially, this volume is a multidisciplinary work of more than twenty specialised researchers, addressing all kinds of cultural and environmental material. The book includes work based on numerous chemical analyses and a long series of radiocarbon dates (much needed for this period) in relation to the corresponding microstratigraphic, stratigraphic, and ceramic sequences. Taken as a whole, the study presents detailed scientific observations and dates interrelated within the framework of a broader interpretive picture, in an effort to understand the specificities of the site, the social actions, the natural and cultural landscapes and the lifeways existing at that point in prehistory. Other sources of funding for the studies presented here include the Institute for Aegean Prehistory, the National Geographic Society, the Field Museum of Natural History, the Wenner-Gren Foundation for Anthropological Research, the Archaeological Institute of America (AIA-Cotsen

Archaeology Grant), and the Wiener Laboratory of the American School of Classical Studies at Athens.

To achieve the full publication of Alepotrypa Cave, an editorial committee was formed, consisting of A. Papathanasiou, W. A. Parkinson, D. J. Pullen, M. L. Galaty, and P. Karkanas. A team of researchers was assembled, as dictated by the needs of the excavated materials. G. Papathanassopoulos, as Director of the Excavation, obtained the necessary permits for the analysis and publication. The researchers undertook and completed their respective analysis and/or sampling within a strict timeframe in order to publish their results in this volume. The aim of each researcher, both in their own right as well as working as a team-member, was first to interpret their own data within the site context, and then to place it within broader chronological, geological and cultural contexts.

From 2012 to 2014 several onerous tasks were completed to facilitate efficient research by the specialists: a) a geo-referenced map of the cave was produced which allows the plotting of the find spots of all artefacts using GIS; b) the conversion of the Diros catalogues from an Excel spreadsheet to a FileMaker Pro database was organised; c) the materials stored throughout the excavation warehouses and the museum were rearranged according to find context and studied (these materials consist of more than 20,000 recorded ceramic sherds, and other finds, more than 3,500 human bones, more than 10,000 animal bones, and another approximately 100,000 uncatalogued, as less diagnostic, ceramic sherds); d) an impressive number and variety of samples for a series of chemical and microscopic analyses were obtained to enlighten specific research questions regarding provenience, dating and site formation processes; and e) a copious effort was made first to locate all the field note books and as many photographs as possible from all the excavation seasons since 1970, and then to retrieve and translate the immense amount of information in those older documents into usable contextual data. The above actions have generated the infrastructure necessary to facilitate the subsequent analyses, including all the necessary contextual, chronological and spatial information.

The volume is dedicated to George Papathanassopoulos, the director of the Diros excavations since 1970, whose personal experience along with the history of the research in Alepotrypa Cave are two trajectories that have been interwoven for the past four decades. Throughout those years he has frequently expressed the joy of the investigations and the discoveries at this unique site and the satisfaction accompanying the continuation of his research, but also he has described the bitterness of the political situation at the time, as well as the various minor and major issues that he needed to arrange and overcome over all those decades with the people and the institutions that supported his work.

The book opens with a presentation of the history of the excavations, as well as a description of the site and its cultural and temporal positioning. The subsequent sections cover: a) the site formation processes, and the stratigraphy of the cave deposits; b) the pottery and its spatial and temporal patterning, typology and technology; c) the stone and bone tools and objects, and their spatial patterning, typology and technology; d) macroscopic, microscopic and chemical analyses of human, faunal and botanical remains; and e) the environmental reconstruction of the area, and the results from the regional survey of the surrounding area. The volume concludes with a synthetic chapter that summarises, combines and interprets all the aforementioned evidence, producing a comprehensive picture clarifying the actions implied by the observed material, and positioning the cave in its broader cultural web. Great efforts were made so that all specialists might present their data and comparisons through time and across space within Alepotrypa Cave, and to that end they were kept informed of each other's work and results.

General questions that were addressed include: refinement of the Neolithic Aegean artefact chronology and typology; tool technologies; long-distance trade of raw materials and pottery; dispersal of communities and cave use in the Final Neolithic; the impact of domestication; population health, movement, and biodistance studies; mortuary space and practice; expressions of ritual; the notions of continuity and monumentality, and of stability, definition and redefinition; permanent versus seasonal habitation/use of a site; exchange as a particular form of social action; and site formation processes and hiatuses in caves. In particular, the ceramic assemblage raises issues of surplus and storage practices, as well as the meanings behind the spatial patterning of the pottery, the personalised syntax of the decoration, and current biases regarding the perception of 'decoration'. Faunal and botanical analyses clarify the importance of terrestrial versus marine resources, as well as domesticated versus wild resources in Greek Neolithic economies, as compared with other European and Anatolian Neolithic societies. Mortuary behaviour, artefactual patterning and human skeletal remains are used to draw conclusions concerning social, cultural and biological conditions and to evaluate patterns of ceremonialism, including the fragmentation and dispersal of material in conjunction with mortuary data.

Individual chapters cover various aspects of material culture and ecological analyses, providing a comprehensive picture of the culture and life-ways of this extended Neolithic site.

The next chapter of this volume is the site description of the cave, within its spatial and temporal limitations, providing a basic reference for the subsequent chapters. A. Papathanasiou first presents the physical Alepotrypa Cave, chamber by chamber, from the entrance to the lake deep within. She sets out the name assigned to each area,

describes the major characteristics and features of each locus, and responds to questions frequently asked by researchers and the general public. Second, she presents the numerous radiocarbon dates of carbonised remains and bone throughout the cave in order to determine the temporal range of the deposits and their chronological sequence, define their possible associations and identify possible hiatuses. Therefore, this chapter is essential for positioning the findings in time and space, as well as the activity areas and all subsequent research inside the cave. Also, it provides a much needed, long, sequence of absolute dates for prehistoric research in Southern Greece and the Aegean.

In the third chapter, P. Karkanas presents his geo-archaeological analysis, based on field observations and the micromorphological examination of undisturbed samples of archaeological sediments. He describes the depositional sequences of Chamber B, in conjunction with the radiocarbon dates, which constitute the backbone for any further archaeological analysis. He also presents the history of the formation of this site, including anthropogenic and natural processes for many areas inside the cave – such as Chambers B, Z, and area Θ 14. He identifies massive clay-floor constructions, episodes of dumping, levelling and repair, periods of abandonment and destruction, and the use of burnt dung, as well as possible hiatuses in the cave's use. Finally, he addresses the abandonment of the cave, and the subsequent formation of the speleothem crust and the dense stalagmite formations on top of the anthropogenic sediments.

In the fourth chapter, B. Katsipanou first presents the results of the immensely complicated work needed to understand the stratigraphy of Trench B1 and merges the older existing stratigraphy with the one that arose from the recent analysis; a vital and long overdue task that is now accomplished. Then she expounds on ceramic identification, positioning the cave in its cultural environment within Neolithic Greece. Specifically, she presents the complete typological seriation of the pottery uncovered in Trench B1, in association with the absolute dates and the microstratigraphy of the trench, which constitutes the backbone of the cultural and chronological sequence of the cave. She analyses and organises the ceramic material with detailed descriptions and drawings of each style, presence in relative quantities, and detailed comparisons, with bibliography and parallels from other sites. She defines the sequence in Alepotrypa and discusses issues of an early appearance of certain styles in relation to what has been published up to this moment. This way the site is meticulously pinned down within the context of the entire Greek Neolithic ceramic typology, and innovations are pointed out and explained by a set of parameters specified to account for them.

In the fifth chapter, S. Katsarou addresses issues of social performance through mortuary practice and the social transformations as manifested in Ossuaries I

and II. First, based on the old field note books, she describes in detail the archaeological context of these two secondary burial sites. Then she analyses, quantifies and categorises the funerary artefactual archive according to style, shape, decoration, typology and manufacturing techniques. She also offers extensive comparisons with material from all published Greek Neolithic sites, and places both the Early and Late/Final Neolithic pottery into its corresponding cultural and temporal positions. Next she reviews the recent bibliography, challenging current notions of completeness, fragmentation and artefactual discard to conclude that ‘Ossuaries I and II seem to have been created not as cemetery areas, but as monument, memory, and veneration areas to challenge constant social reconstitution, renegotiation, and homogenisation’.

In the sixth chapter, K. Psimogiannou sets out to decipher the archaeological and cultural context of another, more interior part of Alepotrypa Cave, namely Chamber Z, a special deposition area. First she conducts a meticulous and detailed presentation of the archaeological context of the site, based on older excavation field notes, before moving on to present the pottery deposited in this locus (wares, shapes, decoration, manufacturing techniques), providing extensive comparisons to other Neolithic sites to produce a cultural and chronological profile, similar to the one attested in Trench B1. De-contextualising the material, she uncovers a repetitive depositional pattern, one involving deliberate fragmentation/destruction, dispersal and structured accumulation of pottery in this particular part of the cave. This behaviour suggests that the people of Alepotrypa, through their specific choices and practices of consumption and deposition of material culture, were actively participating in the wider network of interactions and relations that characterised the Greek Neolithic. In addition, she presents a thorough discussion of cave use in Neolithic Greece and the question of their possible ‘ritual versus domestic’ character.

In the seventh chapter, G. Valvis presents an analytical description of the more than 4,500 sherds of pithoi, which comprise a major portion of the pottery of Alepotrypa Cave. He describes their fabrics, shapes and plastic decoration, including specific and characteristically typological examples, and sets them chronologically within the Late and Final Neolithic periods. Next, he quantifies the spatial distribution of the pithoi sherds throughout the cave, to show that there are significant differences in their presence in the different locations, with an overwhelming concentration of this pottery in the anterior chambers of the cave.

In the eighth chapter, A. Pentedeka lays out the results of the petrographic analysis she conducted to characterise the manufacturing technology and the provenance of the raw materials, with the further aim of examining matters concerning the production, circulation and consumption of the pots in Alepotrypa Cave. The 68 samples, qualitatively representative of the most frequent wares in Chambers B

and Z – namely the various plain monochrome wares, the Black and Grey Burnished, and the decorated wares such as Matt-painted, Polychrome, with relief/plastic decoration, and Urfinis – are attributed to seven fabric groups and two loner fabrics. She concludes that the main recipe for pottery making was within the local pottery tradition, one that was practised throughout the Neolithic in the production of most shapes and wares, while other well-defined recipes existed, seemingly ware- or shape-specific. Imported pottery was ware-specific (Black and Grey Burnished), while the elaborately decorated wares found in quantities in the cave seem to be local. The latter are characterised by compositional homogeneity and constancy in execution through time, possibly implying very specific production and consumption practices highly resistant to change, with Chamber Z having a more ritualistic character and Chamber B one of more variable use.

In the ninth chapter, G. Kourtessi-Philippakis focuses on the typology and the technological analysis of the 868 lithic artefacts from Alepotrypa Cave, as well as the raw materials used for them. She systematically compares their quantitative and technological characteristics to other Neolithic lithic assemblages from caves or open sites to find a closer resemblance mainly with cave sites. She concludes that: a) obsidian was the predominant material used (91.5%) and it confirms the existence of a well-defined supply network in ‘coastal or near coastal sites of a specific regional pattern, the Eastern part of Central and Southern Greece, an area which extends to the southern extremity of the Peloponnese’; b) there is a preference for obsidian blade production; and c) the first stages of the reduction sequence of the obsidian, namely roughing of the blocks and shaping of the cores, did not take place in the cave, but that intensive exploitation and advanced stages of core reduction existed. The assemblage includes 225 tools consisting of retouched blades, notches, denticulates, end scrapers and splintered pieces, indicating that the obsidian tools came ‘ready for use’, while the grey flint ones were knapped locally. Temporally, most lithic artefacts come from the Late Neolithic and their quantity diminishes in the Final Neolithic, while spatially, the striking majority of the material comes from Chamber B, with Chamber A yielding a small white patinated assemblage and Chamber Z another ‘closed’ assemblage, where tools, as retouched blades and notches, are dominant at an exceptional rate of 55.55%.

In the tenth chapter, A. Stroulia analyses the macrolithics, another category in the lithic assemblage, often referred to in the literature as ‘ground stone tools’. The Alepotrypa macrolithic assemblage comprises 306 specimens, which she describes in extensive detail (their raw material, manufacturing techniques, and/or use wear). In parallel with other Neolithic sites, she organises the excavated artefacts into categories and presents their spatial and chronological distribution. She concludes that

four main raw materials are represented in the Alepotrypa macrolithic assemblage: schist, metavolcanic rocks, limestone/marble and hematite. Almost all are imported, and each raw material was used for specific tool types. The fact that most tool types include specimens from different phases implies a certain continuity both in the procurement of raw materials and the ways they were used. She also considers that those who obtained and used the macrolithic raw materials, albeit belonging to many different generations of the same group, followed similar approaches or customs for many centuries. In the last part of her chapter she treats the subject of the presence of macrolithic tools in possibly non-utilitarian/ritual contexts in Alepotrypa and in the Neolithic Aegean, investigating the notion of deliberate deposition and/or fragmentation of some specimens versus casual discard, against the backdrop of the debate on the 'ritual/ceremonial versus utilitarian use' of the cave.

In the eleventh chapter, D. Riebe reports on the compositional results of portable X-ray fluorescence (PXRF) spectroscopy analysis of the obsidian assemblage (238 samples) recovered from Trench B1 of Alepotrypa, from an excavation depth of 0.42 m to 3.93 m. She then compares the data to previously published Melian compositional results. Also, she documents potential shifts in procurement strategies during the Neolithic, by focusing on the diachronic variation in obsidian sources from Trench B1. Her results show that all of the obsidian analysed from Trench B1 likely originated from Melos. Most of the artefacts seem to come from the Sta Nychia quarry (73.95%), while the rest (26.05%) come from the Demenegaki obsidian quarry. She correlates these proportions with diachronic changes in quarry exploitation: she suggests that a shift in obsidian sources used at Alepotrypa took place in the early phase of the Late Neolithic, reinforcing the idea that there was reorganisation of obsidian procurement and an overall lack of control of the sources.

In the twelfth chapter, G. Stratouli presents the assemblage of 116 bone and antler tools (pointed implements, needles, edged implements, composite tools, and other finished objects). She expands on the technological and manufacturing characteristics of the tools, which suggest excellent knowledge and optimal management, and the chronological appearance of specific tool types. She deduces the possible uses of the tools in basketry, matting, weaving, knitting, netting, and hide and leather treatment. She comments on the advanced technical skills required for the observed needle manufacture and concludes that the majority of the artefacts were imported, while some of them were repaired or reused prior to their final deposition in the cave.

In the thirteenth chapter, A. Papathanasiou presents the human osteological material and the observed mortuary variability in Alepotrypa Cave. First, she summarises the demographic characteristics of the 161 individuals

from Alepotrypa and the most prevalent pathological conditions of this group, as well as the results of the dietary isotopic analysis. This last points to a group with an agricultural economy and subsistence strategy, with only occasional exploitation of the near-shore marine protein resources. In the second part she describes in detail the patterns of deposition of the human burials, namely primary single and multiple burials, secondary burials and scattered bone, examining their absolute chronology and their characteristics. Most importantly, she conducts a quantitative analysis of the excavated human skeletal remains, assessing the spatial distribution and the relative representation of the human remains, in an effort to identify any meaningful spatial patterning of the mortuary practices. She concludes that in general the assemblage of Alepotrypa Cave provides a predominant picture of secondary deposition, as it is characterised by higher frequencies of cranial and long bones, the selected elements for reburial, and very low frequencies of the smaller leftovers. Repetition of specific activities through the millennia suggests the persistence of the memory of the place as a significant one, tightly related to formalised and persistent mortuary activities. Perhaps the cave served as a mortuary monument (either for the specific or a broader area), as it displays a degree of memorialisation, by which process the memory of the dead was sustained and extended, through actions of disarticulation, fragmentation, commingling, and moving of the skeletal elements.

In the fourteenth chapter, A. Hadjikoumis deals with the faunal remains from Alepotrypa Cave by means of a highly sophisticated methodology. He determines that the faunal composition of the assemblage is typical of Neolithic Greece, containing high sheep/goat percentages, and especially so by Late and Final Neolithic standards, a bias attributable to the site's type and the surrounding environment. Concerning the animal husbandry strategies Alepotrypa yielded, besides meat production, there exists strong evidence of milk and dairy goods, as well as reasonable evidence of wool/hair exploitation, even from the earliest phases (*i.e.* c. 6000 cal BC). Pig played a secondary role to sheep/goat, but nevertheless an important one, providing significant quantities of meat. Cattle had an overall marginal economic role in comparison to sheep/goat and pig, but its presence added further diversity and security to Alepotrypa's economic system. Although the Early Neolithic samples are small, their comparison with those of Late/Final Neolithic chronology suggests an increase in the importance of sheep and goat at the expense of cattle, pig, and wild animals. Wild animals such as red deer, wild pig, hare and wild carnivores (fox, badger, marten, cat and possibly jackal) may have played additional unknown roles in the sociocultural sphere, but their contribution in terms of meat was modest. Entire animal carcasses were processed and consumed at Alepotrypa throughout its use. There is evidence of skinning, dismembering and filleting for almost all the

identified species. Cooking of meat was primarily done in pots, ovens or pits and less so on an open fire. Finally, Hadjikoumis comments on seasonality, environmental reconstruction, and on the spatial distribution of the animal remains in the cave, which indicates differences between Chamber Z and the rest of the chambers.

In the fifteenth chapter, A. Theodoropoulou presents the results of the study of the numerous and diverse marine faunal material of invertebrate and fish remains. Shells are largely dominated by two gastropod families, namely limpets (Patellidae 60.7%) and topshells (Trochidae 24.8%), with topshells slightly increasing and limpets slightly decreasing from the Late into the Final Neolithic. Both taxa show a considerable size decrease in time, possibly due to the overharvesting of larger individuals during the Late Neolithic. Murex shells, dove shells, and cone shells are also quite important. Fish remains are mainly represented by Scombrids, which make up for 46%, followed by groupers and sparids. The fish material more than doubles (an increase of 2.6 times) from the Late to the Final Neolithic, exhibiting higher diversity, but it does not increase proportionally. She finds evidence for the harvesting of a wide ecological spectrum, marine and estuarine, with year-round cycles of collecting and fishing activities, possibly intensified during the summer. She observes raw consumption of the mollusc foodstuff after crushing, an activity occurring primarily in Chamber B; she also notes that fish remains are concentrated in Chamber B. They were brought in whole to the cave, though for tuna a preference is indicated for the caudal parts, possibly implying long-term preservation. In Chamber D a unique assemblage points to the deposition of selected slices or fillets of the best fish found in the cave. Finally, she presents all the finds of modified shell, such as beads and other ornaments, as well as their manufacturing techniques, and their related symbolism.

In the sixteenth chapter, J. Giblin measures strontium ($^{87}\text{Sr}/^{86}\text{Sr}$) isotope ratios in human and domesticated animal teeth from Alepotrypa Cave and compares the results to previous radiogenic isotope research on archaeological material in Greece and the established isotopic baseline. Her preliminary findings possibly indicate that the people buried in the cave originated from both 'local' and 'non-local' geological contexts. She states that 'the isotopic variability of the humans and animals buried at Alepotrypa may indicate that the site was as an important destination for Neolithic farmers throughout the Aegean ... but ... this hypothesis needs to be evaluated with systematic background sampling throughout the 'local' region as well as a meaningful definition of 'local'.

In the seventeenth chapter, E. Margaritis analyses the botanical remains from Alepotrypa Cave and specifically from excavations at Chamber B, Trench B1A and Chamber D, locus Θ 14, quantifying their spatial distribution and preservation. The crop repertoire of the cave includes 15 different species of cereals, pulses, fruit

trees and other wild species (einkorn emmer, spelt, free threshing wheat, hulled barley, grass pea, vetch/vetchling, common pea, lentil, almond, fig, and wild weed). The sample is characterised by limited quantities, but also by its fragmentary state, which prompts her to discuss charring and crop processing, as well as post-depositional parameters which may have resulted in the observed picture. She notes that long term storage in the cave was not effective. Lastly, she discusses extensively the role of fire, the possibility of the structured deposition of charred plant materials and the symbolic context of food. She points out that 'burnt dung should not only be approached as refuse disposal but its burning can be understood as the symbolic manipulation of matter, while the charred seeds could be referring to transformation, as any kind of rite of passage includes some kind of transformation'.

In the eighteenth chapter, G. Tsartsidou presents the phytolith analysis conducted on the Alepotrypa Cave material, utilising 59 samples from trenches B3, B1, the Petrocheilou profile, Θ 14, Z24, Z22 and LA1. These yielded a variety of plants, adding to the ones recognised in the botanical studies: they included the woody parts, fruits and leaves of trees, reeds, sedges, and the seeds of wild grasses used for both fuel and consumption. Very importantly, she identifies the black sediment samples of the interior of the cave as burnt animal dung, used for fuel, mainly in the interior chambers. Additionally, she offers a series of other conclusions connected with the human activities in and around Alepotrypa, namely: a) the phytoliths identified in the dung-rich sediments suggest that the livestock kept consisted mainly of grazers, i.e. sheep, with some cattle and a few goats; b) no cereal processing was conducted inside the cave; agricultural activities were carried out outside and only seeds that were already dehusked and processed were brought inside for some small-scale processing or small-scale food preparation for immediate consumption; c) possible use of grass straw during the construction of the clay floor/platforms and use of reeds for fences, mats or baskets; d) the lack of cereal husks argues against cereal storage; and e) the interior of the cave shows a ritual character, in contrast to the exterior which shows more evidence of short-term living and small 'domestic'/agricultural activities.

In the nineteenth chapter, M. Ntinou discusses the results of the analysis of the wood-charcoal macro-remains of 125 samples, originating from different contexts throughout the entire cave, in order to investigate the local vegetation setting through time and the selection of fuel types for the different activities carried out inside the cave. From 6,000 to 3,200 cal BC the results indicate that deciduous oak and evergreen or mixed woodland extended even to the southernmost parts of the Peloponnese. Open scrub vegetation was also characteristic, but probably confined to the steeper and stonier ground, though later it might have expanded onto cleared land. The results from the late Early Neolithic to the Final Neolithic imply a diversity of open vegetation which was systematically collected as firewood,

with an extension into the evergreen woodland and deciduous thickets through time, probably as a response to higher demand. She also suggests differentiated use of the cave's space, namely short-term habitational/domestic for the anterior part of the cave and ritualistic in the interior chambers. The rituals involved the use of fire where the main fuels were dung and twigs of Fabaceae, Labiatae, *Cistus* and *Phillyrea/Rhamnus alaternus*. The use of these fuel types, lighter and easier-to-carry than bigger logs, was dictated by the difficult access to the interior chamber. Notable in the same setting is the rare presence of the black pine *Pinus nigra*. The latter does not belong to the local vegetation around Alepotrypa, but is imported from the woodlands of the Taygetos Mountains in order to be used for lighting, due to the resin it contains.

In the twentieth chapter, K. Papayianni and T. Cucchi present the results of their analysis of 47 samples containing microfauna from the Alepotrypa Cave. The Alepotrypa material contains mice of the Murinae subfamily, voles of the Arvicolinae subfamily, snakes of the Colubrinae subfamily, toads and frogs of the Bufonidae and Ranidae families and very few bird bones. The results of the microfaunal analysis from Alepotrypa offer hints for an immediate rocky, steppe environment or cultivated land. They also indicate the typical intrusive activity of burrowers and predators. The discovery of the wild steppe mouse (*Mus spicilegus*) in the anterior part of Alepotrypa is the first evidence for the prehistoric extension of this species, and also indirect evidence for the occupation of the commensal niche in the South of the Peloponnese by this mouse prior to the arrival of the house mouse. This could perhaps pinpoint some food storage in the anterior chamber of the cave, although there is no direct evidence from the pits and vessels found there.

In the twenty-first chapter, M. Boyd and K. Holmgren investigate speleothems, from which they reconstruct the paleoclimate and provide a climate context for the archaeological record. First they detail aspects of the climate itself: at 6,200 BC, there is evidence from the eastern Mediterranean of a cold and dry period of approximately 150–200 years. When thermohaline circulation was resumed, conditions returned to being slightly more moist and warm, but a gradual decrease of humidity and a movement to more arid conditions developed down to around 3,000 BC. They next discuss speleothems from sections of the sampled stalagmites. Those dated after the proposed age of the earthquake which closed the cave at 4,000 BC or before the known period of occupation starting at 6,000 BC are all formed of dense, clean calcite, banded milky-yellow to white or clear. However, a sooty organic material, as well as both interruptions in their growth and corrosion of the calcite, appears in the stalagmites which coincide with human activity and use of the cave. They date the abandonment of the Alepotrypa Cave from samples of calcite taken from crusts found on human bones which have produced

coherent dates. One sample from Z 24 produced an age of $4,220 \pm 470$ BP, and two samples from B7 gave ages of $4,260 \pm 360$ years, and $4,360 \pm 230$ BP respectively. Based on their observations, they suppose that the crust could have formed following a large collapse of the cave roof, with closed cave conditions contributing to increased humidity and reduced ventilation, further combined with more efficient or altered dripwater flow into the cave.

In the twenty-second chapter, D. J. Pullen, M. L. Galaty, W. A. Parkinson, W. E. Lee, and R. M. Seifried review the results of a sophisticated survey conducted around Diros Bay, with intensive collection of sites using grids. The results of their survey provide a glimpse into the history of settlement in the Diros region around Alepotrypa Cave through time. They suggest that the region is characterised by boom-and-bust demographic patterns, interspersed with long periods of abandonment or very limited exploitation and use. Based on the survey data, they identified a definite demographic boom during the Final Neolithic period, with the establishment of the site on Ksagounaki promontory, an open-air extension of Alepotrypa Cave. After the end of the Neolithic and at the beginning of the Bronze Age, the area under study seemed to have been largely abandoned until the Classical-Hellenistic period, when Sites 4 and 6 were established, most likely as part of a port. Diros Bay was not extensively exploited again until the Byzantine and Ottoman periods, when a church and monastery complex were established in the 13th or 14th centuries AD. This initiated the next big demographic boom in the region, as the Mani became one of the most densely inhabited regions of Greece during the Ottoman period.

The twenty-third, and last, chapter by A. Papathanasiou is a synthesis of the results presented in all the previous chapters. It recapitulates the data and integrates them into a comprehensive interpretation of the cultural and chronological contexts of Alepotrypa Cave, as well as its role and its character in the broader landscape, as it emerges from the interdisciplinary study presented in this volume. The chapter also raises the matter of the use of caves in the Neolithic, storage and habitation in a cave, ritual/ceremonial expression, monumentality, continuity, seasonality, structured deposits and patterning, long distance trade, agricultural and husbandry practices and the significance of domesticates.

The twenty-three chapters of this volume cover a corresponding range of research topics, providing a comprehensive picture of the material culture and society represented by this exceptional Neolithic cave. They bring this significant site, one of the most important Neolithic sites in Europe, to the attention of the archaeological community, after more than 40 years of excavations. Furthermore, this volume tightens the relation between the sciences and the humanities, materiality and social practices, and in particular archaeological science and observation with anthropological socialised interpretation.

As Robb puts it, such an approach as the one followed in this volume ‘bridges the gap between our material on the ground and various bigger interpretative pictures’ through detailed scientific study of the materiality of Neolithic social practices (2014, 28). The volume narrates the biography of Alepotrypa Cave, establishes a robust chronology and clarifies the cultural and environmental framework of the site and its era. This was made possible due to the excellent preservation of the site, the dedicated team of researchers and adequate funding. The combined result of this work is presented in this volume, which although comprehensive is in many aspects a preliminary work. It may present more questions than answers and definitely will be reinterpreted and re-evaluated in the future by more investigation and research, both analytical and theoretical.

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Bibliography

- Andreou, S., Fotiadis, M. and Kotsakis, K. (1996) Review of Aegean prehistory. V: The Neolithic and Bronze Age of northern Greece. *American Journal of Archaeology* 100, 537–597.
- Bogucki, P. (1996) The spread of early farming in Europe. *American Scientist* 84, 242–253.
- Coleman, J. E. (1992) Excavations at Halai, 1990–1991. *Hesperia* 61, 265–289.
- Flannery, K. V. (1973). The origins of agriculture. *Annual Review of Anthropology* 2, 271–310.
- Karali, L. (1998) *Τα όστρεα και οι χρήσεις τους στο σπήλαιο Αλεπότρυπα Μάνης*. In E. Kypraiou (ed.) *Πρακτικά του πρώτου Πανελληνίου Σπηλαιολογικού Συνεδρίου Ανθρωπος και Σπηλαιοπεριβάλλον (26–29 Νοεμβρίου 1992)*, 107–114. Athens.
- Lambert, N. (1972) Grotte d’Alepotrypa. *Bulletin de correspondance hellénique* 96, 845–871.
- Papathanasiou, A. (1999) *A Bioarchaeological Analysis of Health, Subsistence and Funerary Behavior in the Eastern Mediterranean Basin: A Case Study from Alepotrypa Cave, Southern Greece*. Unpublished PhD thesis, University of Iowa.
- Papathanasiou, A. (2001) *A Bioarchaeological Analysis of Neolithic Alepotrypa Cave, Greece*. (British Archaeological Report S961). Oxford.
- Papathanasiou, A. (2003) Stable isotope analysis in Neolithic Greece and possible implications on human health. *International Journal of Osteoarchaeology* 13, 314–324.
- Papathanasiou, A. (2005) Health status of the Neolithic population of Alepotrypa Cave, Greece. *American Journal of Physical Anthropology* 126, 377–390.
- Papathanasiou, A. (2009) Mortuary behavior in Alepotrypa Cave: assessments from the study of the human osteological material. In W. G. Cavanagh, C. Gallou and M. Georgiadis (eds) *Sparta and Laconia: From Prehistory to Pre-modern. Proceedings of the Conference Held in Sparta, Organised by the British School at Athens, the University of Nottingham, the 5th Ephoreia of Prehistoric and Classical Antiquities and the 5th Ephoreia of Byzantine Antiquities, 17–20 March 2005*, 21–28. (British School at Athens Studies 16). London.
- Papathanasiou, A. (2012) Evidence of trauma in Neolithic Greece. In R. J. Schulting and L. Fibiger (eds) *Sticks, Stones and Broken Bones: Neolithic Violence in a European Perspective*, 249–263. Oxford.
- Papathanasiou, A., Larsen, C. S. and Norr, L. (2000) Bioarchaeological inferences from a Neolithic ossuary from Alepotrypa Cave, Diros, Greece. *International Journal of Osteoarchaeology* 10, 210–228.
- Papathanassopoulos, G. A. (1971) *Σπήλαια Διρού*, 1971. *Archaiologika Analekta ex Athenon/Athens Annals of Archaeology* 4, 12–26, 149–154, 289–304.
- Papathanassopoulos, G. A. (1992) Νεολιθικά τεχνικά έργα στο σπήλαιο Αλεπότρυπα Διρού Μάνης. In *Πρακτικά του*

- Α' Συμποσίου Αρχαιομετρίας "Σύνδεση Αρχαιομετρίας και Αρχαιολογίας", 26–28 Ιανουαρίου 1990, 43–52. Athens.*
- Papathanassopoulos, G. A. (1996a) Habitation in caves. In G. A. Papathanassopoulos *Neolithic Culture in Greece*, 39–41. Athens.
- Papathanassopoulos, G. A. (1996b) Neolithic Diros: the Alepotrypa cave. In G. A. Papathanassopoulos, *Neolithic Culture in Greece*, 80–84. Athens.
- Papathanassopoulos, G. A. (1996c) Burial customs at Diros. In G. A. Papathanassopoulos, *Neolithic Culture in Greece*, 175–177. Athens.
- Papathanassopoulos, G. A. (2011) *Το Νεολιθικό Διρό*. Athens.
- Phelps, W. W. (1975) *The Neolithic Pottery Sequence in Southern Greece*. Unpublished PhD dissertation, University of London.
- Phelps, W. W. (2004) *The Neolithic Pottery Sequence in Southern Greece*. (British Archaeological Reports Inter. Ser. 259). Oxford.
- Rammou, A. (2009) *Αγγεία καθημερινής χρήσης από το σπήλαιο Αλεπότρυπα Διρού Λακωνίας*. Unpublished PhD thesis, University of Thessaloniki.
- Renfrew, C. (1987) *Archaeology and Language: The Puzzle of the Indo-Europeans*. London.
- Robb, J. (2014) The future Neolithic: a new research agenda. In A. Whittle and P. Bickle (eds) *Early Farmers: The View from Archaeology and Science*, 21–38. (Proceedings of the British Academy 198). Oxford.
- Whittle, A. (1996) *Europe in the Neolithic: The Creation of New Worlds*. Cambridge.

Alepotrypa Cave: the site description and its cultural and chronological range

Anastasia Papathanasiou

Brief history of the discovery of Alepotrypa Cave

Alepotrypa Cave is located in the bay of Diros, on the western coast of the Tainaron Peninsula, Mani, (36° 38' 18" North, 22° 22' 57" East), in Lakonia, Greece (Figure 2.1; CPI 1 and 2). The cave is situated about 20 m above sea level, in an arid and rocky limestone environment; its entrance is about 50 m from the present Mediterranean shoreline. It is a massive karstic formation about 300 m long and 50 m in maximum width, extending along an east–west axis. Within lie several passageways and chambers, the largest of which contains a deep lake and several smaller ones with brackish but potable water (Figure 2.2; CPI 3). Alepotrypa revealed stratified anthropogenic deposits up to 5 m deep, which date from approximately 6,000 to 3,200 cal BC and correspond to the end of the Early, Middle, Late and Final Neolithic Periods. The pottery is typical of the southern Greek Early to Final Neolithic, with imported vessels from as far north as the Balkans. Other artefacts include obsidian and flint tools, stone axes, grinding-stones, copper daggers, unworked copper nuggets and slag, bone needles, clay spindle whorls, items for personal decoration (shell and stone beads, bracelets of *Spondylus gaederopus* shell), as well as marble and clay figurines. Features include hearths, clay-lined pits, clay floors, and round clay ovens. Food refuse consists of cultivated cereal, legume, and fruit remains, a large number of animal bones from domesticated species (sheep, goat, cattle, and pig), and to a lesser degree the remains of wild resources (deer, shellfish, and marine fish). In addition to the material culture, the cave has also yielded the largest human skeletal assemblage of Neolithic Greece, including remains of primary single or multiple burials, ossuaries for secondary disposal, and

scattered bone: these are accompanied by evidence of rich ritualistic expression, including massive concentrations of deliberately broken pots, possibly associated with mortuary practices. In addition to the presence of human activities inside the cave, there is abundant evidence of Neolithic occupation of the surrounding area. The cave entrance may have collapsed, probably during the Final Neolithic, and some individuals may have been trapped inside. A stalagmite crust was formed on top of the last layer on the cave floor and covered the existing exposed cultural material, invariably comprising pottery, animal bones and human skeletal remains: it thus preserves intact a picture of the past. The area was essentially abandoned after this period and the cave remained undisturbed until 1958.

Alepotrypa Cave was known to the modern community living in the Diros area as a small opening, a hole in the sloping terrain, that small animals like foxes entered when being chased by hunting dogs, emerging unscathed later. Hence the name of the cave was coined: Alepotrypa meaning Foxhole (Figure 2.3). It was officially discovered and recorded in 1958 by the Greek Speleological Society and the Petrocheilos husband and wife team. In the absence of any archaeological surveillance, it was incorporated into a plan of extensive touristic exploitation, in conjunction with the nearby cave of Vlychada or Glyfada, which had already been developed as a profitable tourist attraction by the Greek Tourist Service (EOT). The land around the two caves (approximately 110,000 m²), which was owned by local families, was appropriated during 1968 by the Greek State on behalf of the EOT in order for the latter to develop, use, and manage the area for the purposes of tourism. Part of this area in 1998 was characterised of archaeological significance and was

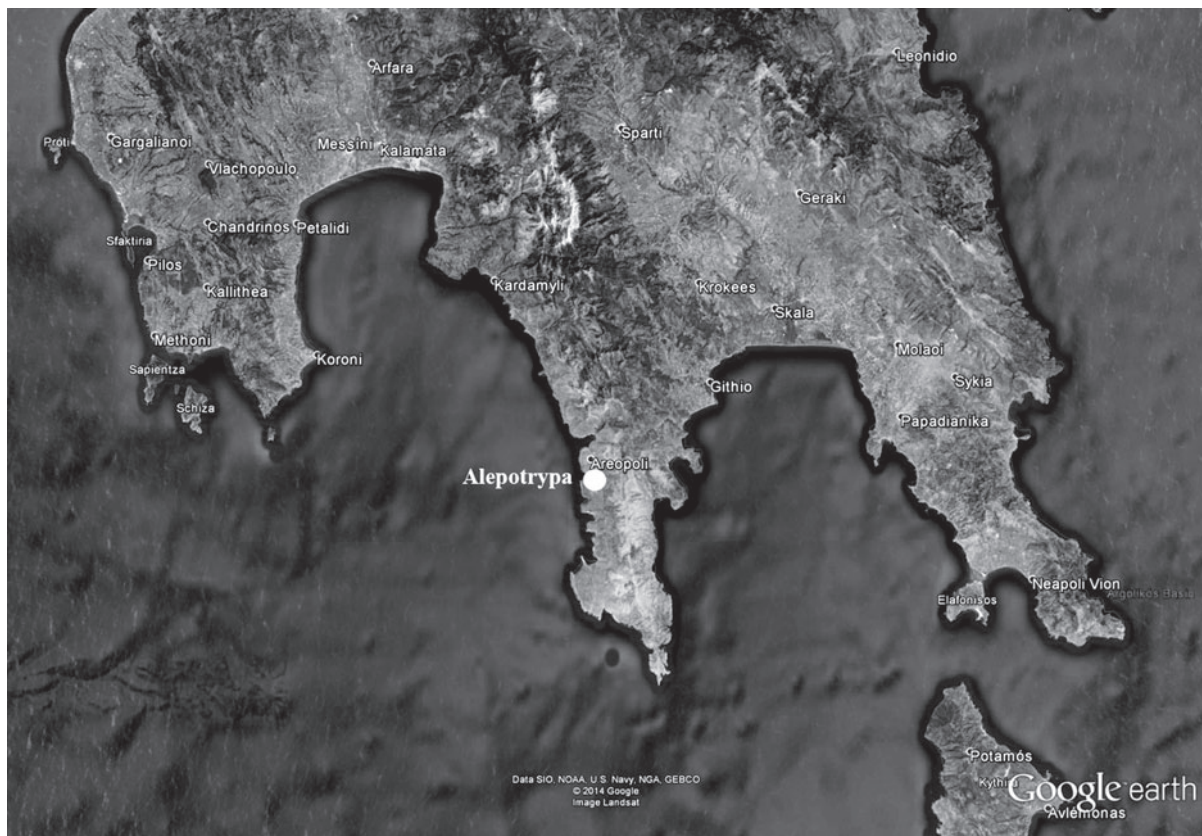


Figure 2.1. Alepotrypa on the map of Greece.



Figure 2.2. Aerial photo of Diros Bay with Alepotrypa Cave floor plan superimposed. Note the truncated part of the mountain at the entrance of the cave for the road construction (by Rebecca Seifried).

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Μειονεκτήματα τοῦ σπηλαίου διὰ τὴν ἀνωτέρω ἀξιοποίησιν εἶναι ἡ δυσκολία κατασκευῆς ἀμαξιτῆς ὁδοῦ μέχρι τῆς εἰσόδου τοῦ καὶ ἡ ἀνάγκη χρησιμοποίησεως ἰδιαιτέρας γεννητρίδας διὰ νὰ ἡλεκτροφωτισθῇ, ἐπειδὴ εὐρίσκεται μακρὰν ἡλεκτροφόρων ἀγωγῶν.

Τὸ ζήτημα τῆς ὁδοῦ ὅμως θὰ ἀντιμετωπισθῇ μετὰ τοῦ σπηλαίου ἀρ. 25 ὁδὸ φωτισμὸς εἰς τὸ σπήλαιον τῆς πρώτης ἐκμεταλλεύσεως τοῦ θὰ δύναται νὰ γίνεταί διὰ λάμπας ΛΟΥΞ, χρησιμοποιοῦμένην μόνον μαγνητοῦ διὰ τὸν φωτισμὸν τῆς μεγάλης αἰθούσης.

ΤΟ ΣΠΗΛΑΙΟΝ ΑΡ. 923

ΕΙΣΑΓΩΓΗ

Τὸ σπήλαιον τοῦτο μέχρι τοῦ Μαΐου 1958 ἦτο γνωστὸν ὡς ἓνα μικρὸν κοίλωμα μὲ πολὺ στενὴν καὶ χαμηλὴν εἰσοδόν, εἰς τὸ ὁποῖον ἐκρίπτοντο ἀλώπεκες.

Εἰς αὐτὸ ἐνδοτε εἰσέδον κυνηγετικοὶ κύνες, καταδιώκοντες τὰς ἀλώπεκας, ἀλλὰ οὐδέποτε κατόρθωναν νὰ συλλάβουν αὐτάς.

Ἐνεκα τοῦ ἀνωτέρω λόγου τὸ σπήλαιον ἀρ. 923 ὀνομάζετο Ἀλεπότρυπα.

Ἀλεπότρυπες λέγονται εἰς ὅλην τὴν Ἑλλάδα γενικῶς τὰ σπήλαια, τὰ ὁποῖα ἔχουν κολὺ μικρὰς εἰσόδους. Αὐτὰ εἶναι τὸ -σον διανεμημένα εἰς διαφόρους τοίπους ὥστε πάντοτε γίνε -ται σύγκρισις μὲ τὰς ὀνομασίας των καὶ ἀπαιτεῖται εἰδικὸς προσδιορισμὸς.

Ἡ Ἀλεπότρυπα ἀρ. 923 ὡς κειμένη παρὰ τὴν θέσιν Πορταράκια τοῦ Δυροῦ δεῖον νὰ ἔχῃ ἀνάλογον προσδιορισμὸν ἐκ τῆς θέσεως αὐτῆς.

Οὐδὲν εἶναι γνωστὸν εἴτε ἱστορικῶς εἴτε ἐκ παραδόσεως διὰ τὸ σπήλαιον ἀρ. 923. Ἡ ἐφετερινὴ ἀνακάλυψις τοῦ ἦτο τυχαία καὶ ἐγένετο κατόπιν ὑποδείξεως τοῦ ἐκ Πύργου Στεφάνου Κουλάκου, ὁ ὁποῖος ἐβοήθησε τοὺς σπηλαιολόγους νὰ εἰσέλθουν εἰς αὐτὸ διὰ μετεκινήσεως τῶν χωμάτων, τὰ ὁποῖα ἐφράττον τὴν εἰσοδὸν τοῦ.

ΘΕΣΙΣ ΤΟΥ ΣΠΗΛΑΙΟΥ

Ἡ εἰσοδὸς τοῦ σπηλαίου εὐρίσκεται ἐντὸς ἀγροῦ ἐλαιῶν τοῦ ἐκ Πύργου Δυροῦ Κυριάκου Κουλάκου, παρὰ τὴν ῥίζαν μεγάλῃς ἐλαίας καὶ ἐπὶ τῆς δεξιᾶς πλευρᾶς μικρᾶς ρευματιᾶς, ἡ ὁποία καταλήγει εἰς τὸ μέσον τῆς ἀκτῆς Πορταράκια τοῦ

Figure 2.3. Bulletin de la Société Spéléologique de Grèce (IV, Fasc. 5, 6, January–June 1958, 83). First report on the discovery and the name of Alepotrypa Cave (cave number 923) by the Greek Speleological Society.

given to the Greek Ministry of Culture for research and preservation of the site. As extensive modifications had to be made inside the cave, in order to make it accessible to visitors, the construction works of that period, already underway early in the 1960s, caused severe disturbance

to the archaeological deposits inside the cave. These construction projects sometimes involved the complete destruction of anthropogenic deposits: for example, in the first chamber of the cave, the deposits in an area of some 10 × 8 m, and up to 2 m deep, were removed and

discarded. The works included major interventions, the most important being: a) the enlarging of the existing hole/entrance with explosives to permit access on foot; b) the removal of the deposits of the first chamber, again to allow ready access, by using controlled dynamite explosions; c) the widening of certain low or narrow points in the same way; d) the construction of cement pathways, staircases and bridges to create a one-way route for visitor flow; e) the installation of electrical cables to light every corner of the cave; and f) pumping out of the lake water and its transportation through pipes to the areas outside the cave to water the plants and to assist waste disposal in the buildings being constructed (the locale had no other access to water).

As the construction works were progressing, several artefacts and human skeletal remains were discovered or became visible on the cave floor. Recognising that these might be of some particular importance, Anna Petrocheilou, who was in charge of the development,

collected the most impressive of them into large baskets (see the illustrations in Papathanassopoulos 2011, 28–29), which she eventually sent to the Archaeological Museum of Sparta. She fenced in some of the built structures and other *in situ* features inside the cave, which she could recognise as important even if not readily interpretable, in order to enhance the tourist route and experience. The contents of the baskets and other finds reported from Alepotrypa Cave raised the alarm in the Archaeological Service and in 1970 G. Papathanassopoulos visited the site. To prevent any further destruction, in 1970 the Greek Ministry of Culture assumed management of the site, under the direction of Papathanassopoulos, halting tourist access and any other potentially destructive activities. Systematic research and excavation was begun: excavations at the site were initiated on the 16th of July, 1970 (Papathanassopoulos 1971a, 1971b, 1971c, 1996, 2011; see also Lambert 1971, 1972; see Figures 2.4 and 5).

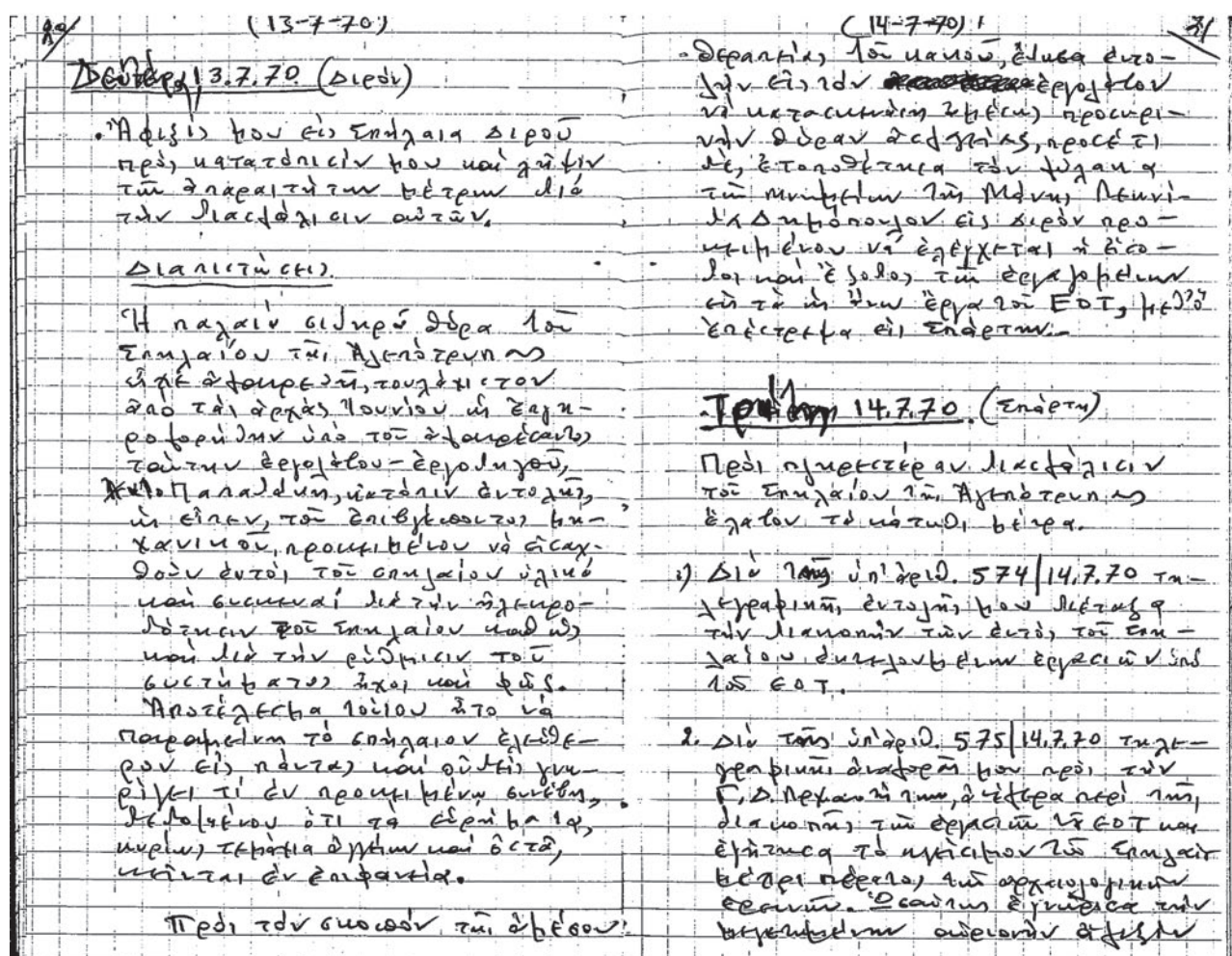


Figure 2.4. Page of G. Papathanassopoulos's handwritten note book, on his first visit to Alepotrypa Cave on 13/7/70 (Papathanassopoulos archive).

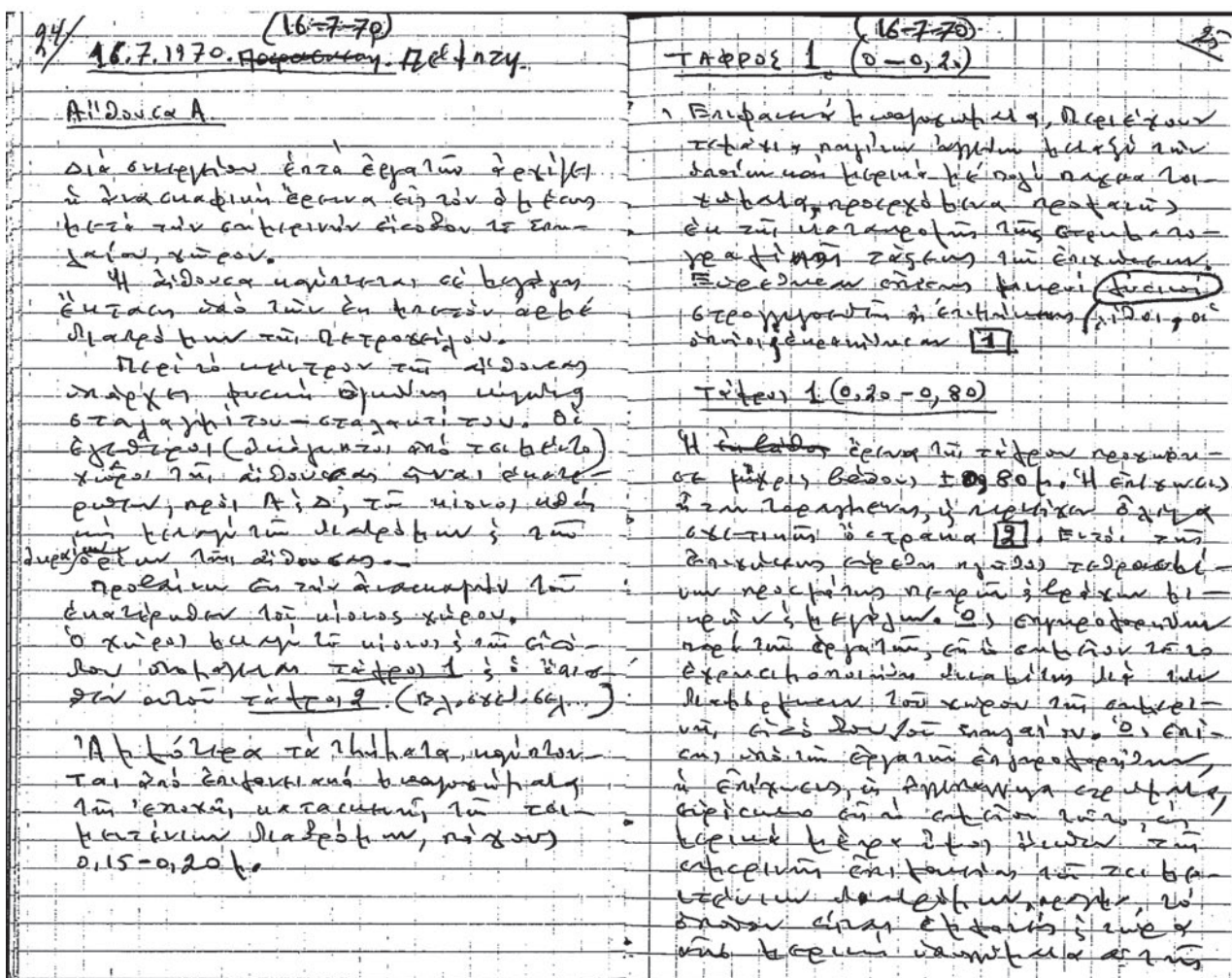


Figure 2.5. Page of G. Papathanassopoulos's handwritten note book, at the beginning of investigation of Alepotrypa Cave on 16/7/70 (Papathanassopoulos archive).

Description of the areas in Alepotrypa Cave

This section presents a brief description of the different chambers and activity areas that were identified inside Alepotrypa Cave in 1970. They constitute the basic spatial reference system employed in the inventories and the research. A surface survey in the cave named seven chambers and approximately 70 individual loci or 'Theses' (see the map in Figures 2.6 and 7; CPI 3). The chambers were designated as Chambers A, B, G, D, E, Z, H and L or in Greek A, B, Γ, Δ, E, Z, H, and Λ. The loci are characterised either by the letter of the chamber and a number, or by only a number, in a clockwise sequence: A/1–7, B/1–8, D/9–14, E/15–19, Z/20–24, L/25–44, Loci 45 and 46 which are located on the upper floor, and finally G/47–49. For Chambers A and B, both the chamber letter and the locus number are necessary for identification as the numbering starts from 1 in both cases and there would otherwise be confusion. In the rest of the chambers, the locus number alone can identify the specific location. If it is not preceded by the chamber letter, then it is given with

the prefix TH or Th or in Greek Θ (a *thesi*/θέση means a 'locus'). Sometimes these loci are subdivided, with the smaller units designated by a lowercase letter: thus Θ18a, or Th 27a–27d and occasionally they may bear special names (Niche 31, Ossuary I, Ossuary II etc.). The physical delineation of the different loci was arbitrary: it follows the geomorphology of the cave for the sake of ease of reference. Sometimes as a result the borders between the loci are not clear-cut. Moreover, although distinctive features may very often exist at the surface level, these same distinctions can disappear in lower layers and earlier periods as expected.

Chamber A is the first chamber one encounters, located at the present entrance of the cave: the initial entrance hole was located in its upper part. Actually it is the west half of a larger chamber, whose eastern part is Chamber B (Figures 2.8 and 9). In prehistory, it was one of the most used areas of the cave, acquiring deposits of approximately two metres deep over an area of more than 50 m². Almost all the cultural deposits of Chamber A were removed and destroyed during the construction works to open the present

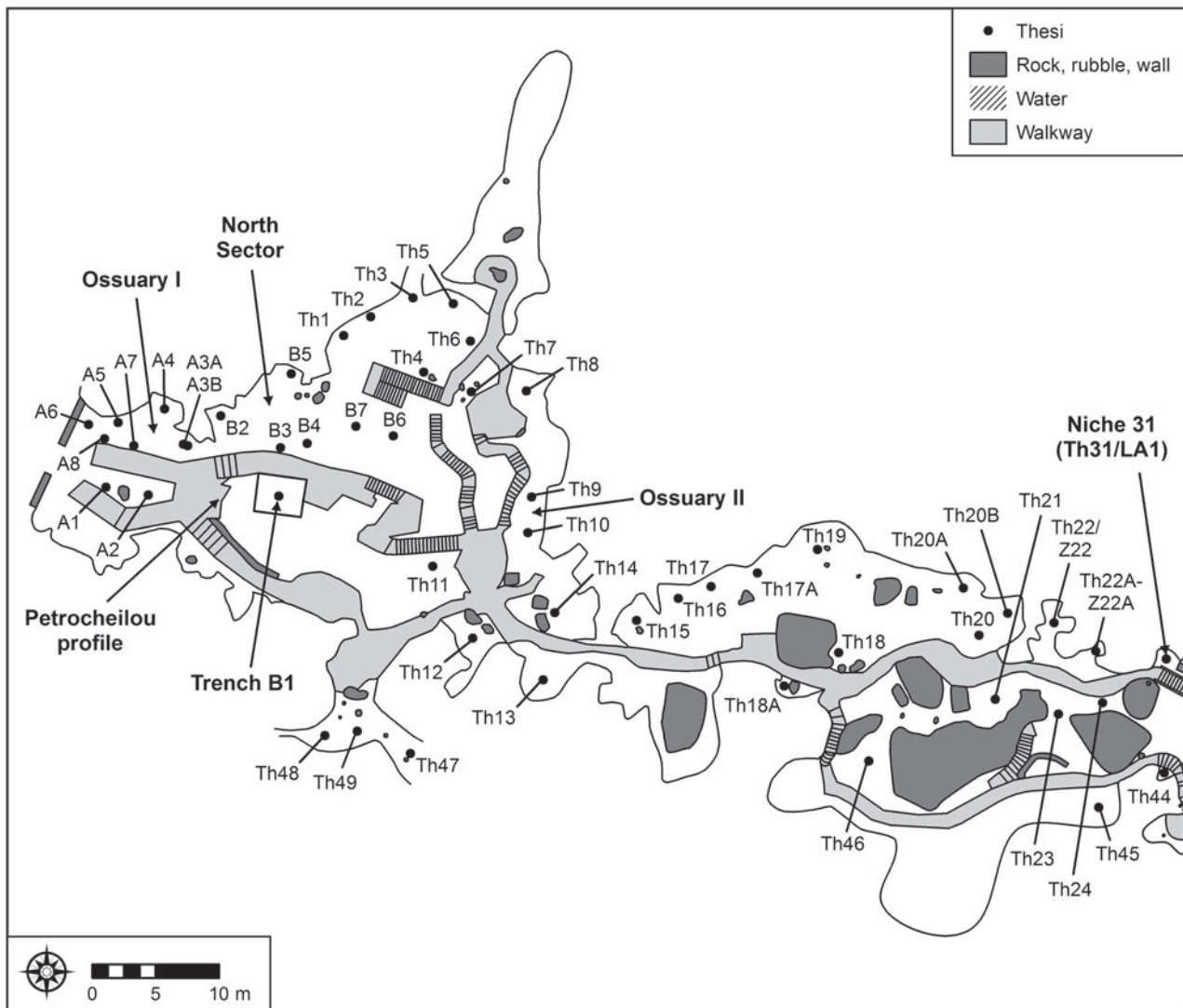


Figure 2.6. Map of the west half of Alepotrypa Cave, with all the numbered activity areas (Th/Θ) (by Rebecca Seifried).

entrance. The level that a visitor stands on today here is very close to the original Early Neolithic floor, at the start of human activity in the cave. The original cave floor is visible between the cement pathways, where the remaining undisturbed deposits were later excavated, exposing it. The final (anthropogenic) cave floor, under the stalagmite formation laid down after the abandonment of the cave in the Final Neolithic, is still visible around the cave walls: it stands more than two metres above the initial, natural floor. The line where the removal of the deposits was stopped is also clearly visible: it is called the ‘Petrocheilou profile’ (CPI 4). The deepest deposits of Chamber A, below the cement walkways, were then left intact. Divided into five areas, they were excavated, in certain areas right down to the original cave floor. At the loci A/3 and A/4, an ossuary was identified, Ossuary I, which belongs, as expected, to the earliest phases of the use of the cave at the end of Early Neolithic. Ossuary I contains consecutive child burials in its initial phases; above is the secondary burial of a

significant amount of disarticulated bones, representing several individuals through time (see Papathanasiou and Katsarou, this volume).

Chamber B (CPI 6) is, as mentioned above, the east continuation of Chamber A (geomorphologically, A and B constitute a single chamber). The border between them is marked by the cut-line left by the destruction of the deposits. Therefore the deposits of Chamber B correspond to the east segment of the mound of stratified deposits inside the two chambers (A and B), the west segment having been removed as mentioned above. The mound in Chamber B was excellently preserved over an area of approximately 75 m². This mound was selected for the first excavation trench, named Trench B1, inside the cave in 1970, with initial dimensions 2.75 × 1.80 m. Today Trench B1 reaches a depth of 4.80 m, while test coring shows that the base of the cave may be only 20 cm lower. Trench B1 exhibits the complete cultural sequence of the cave from the Early Neolithic to the Final Neolithic (see Karkanas for the microstratigraphy

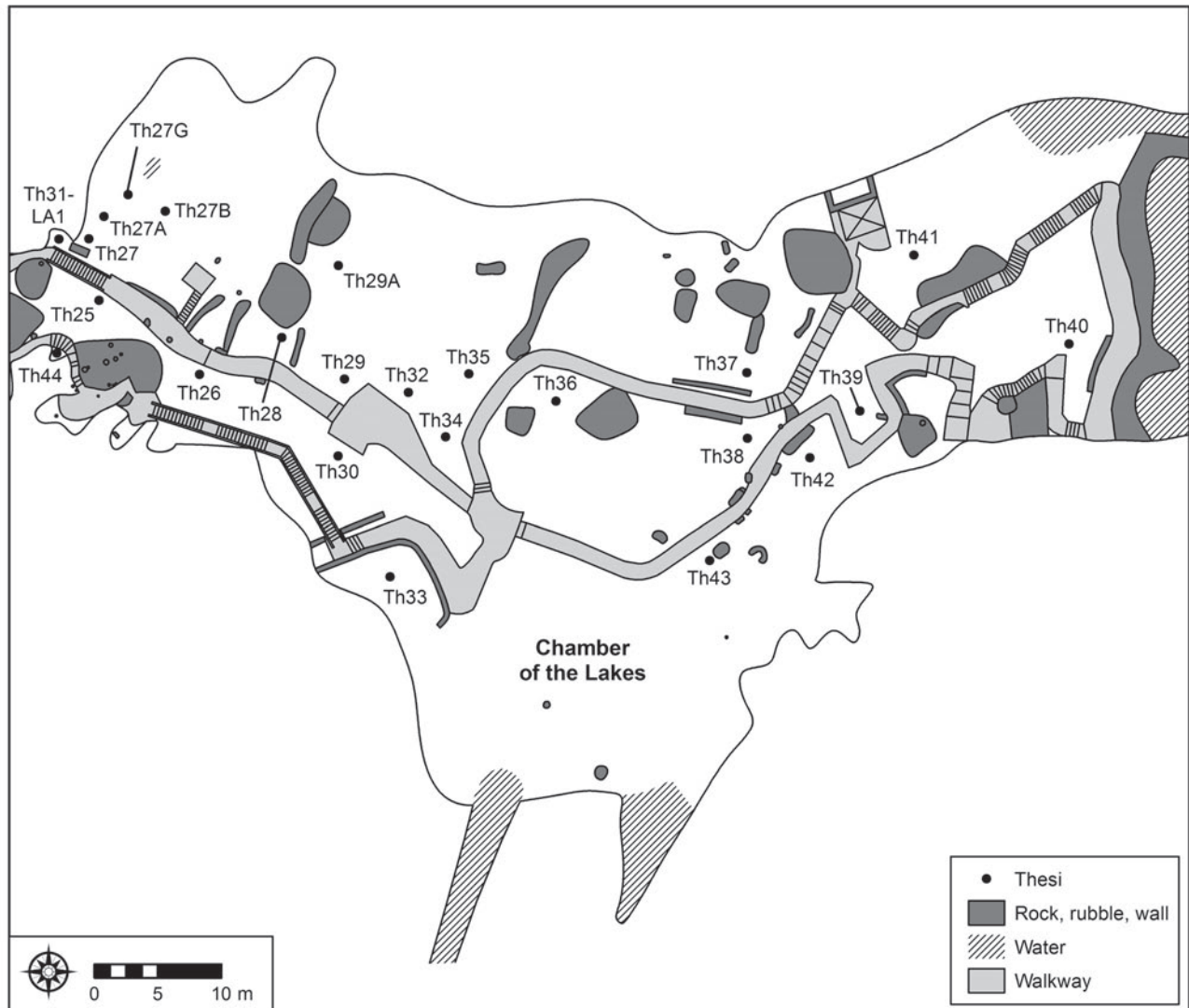


Figure 2.7. Map of the east half of Alepotrypa Cave, with all the numbered activity areas (Th/Θ) (by Rebecca Seifried).

and Katsipanou for the ceramic typological sequence, both this volume). It yielded several consecutive clay floors, the profiles of two clay-lined pits, hearths, tools, pottery, animal bones, and a number of human burials, namely a single primary burial of a female, the multiple burial of approximately eight individuals and another primary burial of an adolescent in its earliest layers (CPI 5). The north part of Chamber B is called the North Sector (CPI 7) and is divided into subareas from B/2 to B/8 (B/2 is also called κόγχη σκύφου). It corresponds stratigraphically and chronologically to the upper layers of Trench B1, being an extension of them; it is dated to the Final Neolithic. It is characterised by hearths, clay floors, clay-lined pits and an abundance of pottery, either plain or with plastic decoration and including several large-sized vessels.

Chamber G constitutes part of the upper floor of the cave and the extension of B to the south. No archaeological research has been conducted there, except for surface collections at Θ (Th) 47–49.

Chamber D lies to the east of Chamber B and on a much lower level. An inclined shaft, a few metres deep and several wide, separates the two chambers. It is divided into subareas Θ 9–14 (or Th 9–14 or D 9–14), which are natural niches of the cave. The first two, D/9 and 10 (or Θ 9 and 10 or Th 9 and 10) were first excavated in 1971; they constitute Ossuary II which is dated, in its excavated upper part, to the Final Neolithic. It contained carefully laid-out human crania and long bones in a secondary deposition (see Katsarou and Papathanasiou, both this volume). Opposite and to the west is another locus, D/11 (or Θ/11 or Th/11) (or κόγχη κανάτας), where five almost complete vessels were found on the niche's surface. About a metre further to the south-west two more loci were identified as D/12 and 13 (κόγχη ιπνών), connected with a clay basin and two clay thermal structures covered with burnt material. A little further to the west and on the opposite side of the corridor D/14 (κόγχη αμφορέα) there is another natural niche, where a complete vessel



Figure 2.8. Alepotrypa Cave, Chamber A, looking west to the present entrance (ASCSA archive).

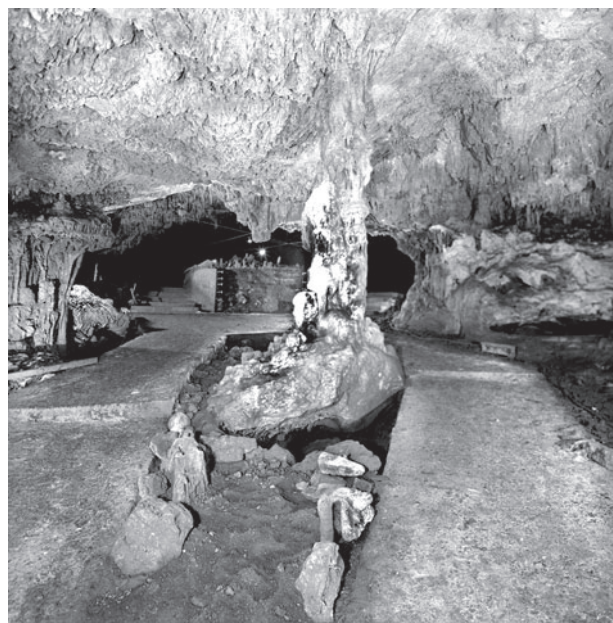


Figure 2.9. Alepotrypa Cave, Chamber A, looking east to Chamber B (ASCSA archive).

covered by an inverted small bowl stood on the surface of the cave floor which is stone-covered in this area (Papathanasopoulos 2011). The lower layers of this niche consist of alternating strata of ashy deposits-clay floors-carefully laid sherds. A partial human burial is still lying on the lowest exposed layer. The entire context is dated in the Final Neolithic (see Karkanas, Tsartsidou, Ntinou, Margaritis, all this volume).

Chamber E is the continuation of D to the east beyond a very narrow passage, which was even narrower in antiquity, before work to widen it was undertaken, by blasting out the lower part of the rock. Only a surface collection was conducted in Θ/15–19, since it is primarily filled with natural clay, supposedly filtering down from the outside through crevices.

Chamber E continues to the east as Chamber Z. This is made up of subareas Z/20–24 (or Th/20–24) that present a different picture. The sediment that covers it to the greater extent is black, and has been identified as burnt animal dung. All of area Z and the niches in it yielded a massive accumulation of successive layers of deliberately broken pottery, primarily of closed shapes and painted decoration, mixed with excellent quality ornaments and stone tools and small quantities of animal and scattered human bones (see Psimogiannou, Karkanas, Tsartsidou, Ntinou, Hadjikoumis, all this volume). The entire area was used from 6,000 to 3,880 cal BC (as radiocarbon dating indicates) in the same ritualistic way. At the east end on the left of this chamber Niche 31 (or Th 31 or LA1) was investigated. Dated to the Final Neolithic, Niche 31 (or Th 31 or LA1) reveals the same ritual involving the deliberate fragmentation of pottery, in this case in association with the secondary deposition of the skeletal remains of two children.

Chamber Z leads to the east to Chamber L, or the Chamber of Lakes (CPI 8 and 9). The small corridor along the central part of Chamber Z opens up at its end into the top of the huge, spectacular Chamber L. This has an approximately 35m high domed ceiling and contains a few small lakes and one large one at its easternmost end, all with brackish fresh water (CPI 10). Only a surface collection was conducted in this chamber which is subdivided into loci Θ/25–44 (or Th/25–44). Cleaning on a small scale was performed on the so-called Neolithic staircase, which possibly connected and gave access to/from the elevated Chamber Z to the floor of the Chamber of Lakes.

Radiocarbon dating

Given the necessity for direct dating at Alepotrypa, both to determine the temporal range of the deposits and their chronological sequence, and to associate this with the relative dating derived from the pottery sequence, several samples were selected for radiocarbon dating. This produced absolute dates applicable to prehistoric research in Greece in general, and in southern Greece and the Aegean in particular. Starting in 2009, a long series of analyses was undertaken at the Oxford Radiocarbon Accelerator Unit (ORAU), first on human bone samples and, after the establishment of the microstratigraphical study and with the contribution of P. Karkanas, on charcoal samples. Altogether, 34 samples yielded valid results and produced dates ranging between 6,220–6,030 cal BC (OxA-29203 $7,246 \pm 36$ BP) and 3,370–3,100 cal BC (OxA-29167; $4,542 \pm 35$ BP), dating the site from the end of the Early Neolithic to the Final Neolithic, thus extending the known use of the cave back by a millennium. The dated samples

come from a variety of locations and depths from the cave in order to attempt the reconstruction of its use to the maximum possible degree of refinement in time and space and to identify any possible association between different areas. With the aid of the available older field note-books and the integration of archaeological and microstratigraphical observations by Karkanas, it became possible to define several occupational phases (as well as hiatuses), and to demonstrate chronologically related areas of the cave in parallel use (and ambiguous ones). The definition of the layers microstratigraphically and their chronological sequence is presented by Karkanas in the following chapter, the dating of the human burials is discussed by Papathanasiou (this volume, Chapter 13), and the dating of the ceramic typological sequence in Trench B1 is discussed by Katsipanou (Chapter 4). The groups of dates acquired from the charcoal samples in the locations/trenches were neatly and independently confirmed by the dates obtained from the human bones found in different parts of the cave, therefore verifying the occupation phases and their absolute ages and determining the time-frame for the ceramic sequence.

Regarding the radiocarbon results (Table 2.1), the first appearance of human activities in the cave is confirmed by five samples from three different areas of the cave and can be securely placed at approximately 6100 cal BC, with more dates clustering around 6000 cal BC or culturally at the end of the Early Neolithic. Specifically, three dates of 6,220–6,030 cal BC (OxA-29203; $7,246 \pm 36$ BP), 6,100–5,930 cal BC (OxA-22037; $7,162 \pm 38$ BP) and, 6,210–5,990 cal BC (OxA-29209; $7,192 \pm 37$ BP) come from three different human burials in Chamber A at Ossuary I. A date of 6,010–5,880 cal BC (OxA-29208; $7,071 \pm 36$ BP) comes from the adolescent burial at the bottom of Trench B1 and a date of 6,070–5,920 cal BC (OxA-29788; $7,128 \pm 34$ BP) came from a dung sample from the lowest layer of Niche 22 (or Th/22 or Θ/22 or Z/22) in Chamber Z. The end of the use of the cave is less readily determined.

The latest date of 3,370–3,100 cal BC (OxA-29167; $4,542 \pm 35$ BP) comes from the uppermost layer of Trench B1, just underneath the stalagmite crust, but it is the only example of such a late date. The next closest sample is 3,970–3,790 cal BC (OxA-29789; $5,092 \pm 32$ BP), from the human skeleton lying on the surface of Z20 (or Th/20 or Θ/20). There are more, very close dates deriving from all areas of the cave; thus in Chamber D from Ossuary II a date of OxA-22567, 3,970–3,790 cal BC (OxA-22567, $5,094 \pm 31$ BP), and in layer 3 of Trench B1 of 3,970–3,800 cal BC (OxA-26355; $5,097 \pm 31$ BP).

One interpretation of this data-set is that the interior part of the cave ceased being used around 3,900 cal BC, probably due to a rock collapse and subsequent blocking of the passage. This event might have happened prior to the abandonment of the anterior part of the cave, where another episode of collapse may have been involved at the entrance of the cave, perhaps 700 years later, around 3,250 cal BC.

Other than the six dates which identify the cave's earliest and the latest use, the majority of dates, 18 of them, come from a variety of locations inside the cave and cluster between 4,240–3,990 cal BC and 3,970–3,790 cal BC (Table 2.1): namely the Final Neolithic. Specifically, these 18 samples are made up of six from Ossuary II, five from Chamber Z, two from the north sector of Chamber B, one from Niche 31 (or Th 31 or LA1) at the entrance of the Lake Chamber, one from the upper part of the Petrocheilou profile, and three from Trench B1, one each in layers 2 and 3 and the human burial in layer 4. This burial most probably chronologically belongs stratigraphically to either layer 2 or 3, but the inhumation pit is cut into layer 4. The Final Neolithic is a time when the cave definitely was flourishing, but a bias in research may also be operating here. This time period was more heavily investigated by the excavations, as it corresponds to the upper layers in many different locations. Neither in Ossuary II nor in the North Sector did excavations reach the sterile bedrock. In the areas where sterile was reached (Ossuary I, Trench B1, and Z22) dates for the Early Neolithic were obtained. The other ten samples all come from Trench B1: they encompass the layers between the depths of 1.21 m to 4.53 m, namely the stratigraphical sequence from the Middle and Late Neolithic, as is described in detail, layer by layer, by Karkanas (this volume), identifying distinct occupational phases separated by possible hiatuses.

To summarise, the radiocarbon results show the following patterns. In Chamber A, in Ossuary I, the original cave floor was reached: it has yielded secure Early Neolithic dates, but not any later ones. This was expected as Ossuary I is situated below the cement walkway; thus it was one of the few deposits in this chamber left intact and that could be excavated. All the deposits above this level, which would have corresponded to later phases, had been dug out and removed during the construction of the walkways.

In Chamber B, Trench B1 yielded the entire chronological spectrum from the end of the Early Neolithic to the Final Neolithic, with phases of more or less dense occupation and phases of possible abandonment (see Karkanas, this volume). Some broad generalisations can be made regarding the tentative cultural sequence of the deposits and the artefact chronologies (Table 2.2), although some sloping of the deposits may affect the outcome. Namely, the deposits ranging in depth from 4.80 m to 4.60 m can be securely attributed to the later phases of the Early Neolithic, at around 6,000 cal BC. The deposits ranging in depth from 4.60 m to 4.00 m, at around 5,500 cal BC, can be considered to belong to the Middle and Late Neolithic. The deposits ranging in depth from 4.00 m to 2.80 m are the most problematic portion and are less securely dated, as at that segment depth inconsistencies are observed and few valid samples exist, but they most probably belong to the Late Neolithic. The deposits from between 2.80 m and 1.80 m securely date to the Late Neolithic. The deposits sited from 1.80 m

Table 2.1. Summary of radiocarbon samples and dates from Alepotrypa Cave

OxA Code	Sample	Chamber	Location (Th)	Feature/Layer/ context	Depth (m) relative (day-book)	Height (m) absolute	Radiocarbon ages (yr BP)	Delta C^{13}	Calibrated ages cal Bc 1 sigma	calibrated ages cal Bc 2 sigma
<i>B1 trench</i>										
29167	AC16/103	B	1	Layer 1	0.15	19.51	4542 ± 35	-27.0	3370–3110	3370–3100
X-2468-33	B1SC3	B	1	Layer 2	0.51	19.15	5195 ± 75	n/a	4230–3840	4240–3800
26355	B1CS4	B	1	Layer 3	0.82	18.84	5097 ± 31	-24.3	3960–3810	3970–3800
29077	AC17/104	B	1	Layer 4	1.21	18.45	5656 ± 30	-24.1	4520–4450	4550–4370
29207	AC14 single burial	B	1	Layer 4	1.65–1.75	18.01–17.91	5178 ± 34	-19.5	4040–3960	4050–3940
26356	B1CS7	B	1	Layer 5	1.45	18.21	5791 ± 33	-25.5	4520–4450	4550–4370
26378	B1SC8	B	1	Layer 7	1.65	18.01	5963 ± 33	-23.7	4900–4790	4950–4740
26357	B1CS9	B	1	Layer 8	1.95	17.71	5880 ± 31	-26.1	4790–4720	4830–4690
29275	AC19	B	1	Layer 9	2.76	16.90	5982 ± 36	-25.8	4940–4800	4990–4780
22013	A2201 multi-burial	B	1	Layer 14	4.02	15.94	6415 ± 35	-19.7	5470–5360	5480–5320
22012	A2197 multi-burial	B	1	Layer 14	4.02	15.94	6441 ± 38	-19.7	5480–5370	5480–5330
26358	B1L807	B	1	Layer 14, sq. L, context 807	4.27	15.89	6417 ± 34	-25.4	5470–5360	5480–5320
29168	AC20	B	1	Layer 15 top	4.35	15.71	6435 ± 40	-26.3	5470–5370	5480–5330
31015	AC K845	B	1	Layer 15 middle	4.53	15.53	6788 ± 37	-24.5	5720–5650	5740–5630
29208	AC15 last burial	B	1	Layer 15 bottom	4.80	15.26	7071 ± 36	-19.3	6010–5910	6010–5880
<i>Other areas</i>										
29202	AC7	B	3	Lower part	0.95	ca. 18.5	5122 ± 31	-19.7	3980–3810	3990–3800
22011	A 1291	B	4	Context 95	0.65–0.80	ca. 18.5	5158 ± 36	-20.0	4040–3940	4050–3811
26359	PCCS3	A	PC	Upper part of section	0.36	18.98	5235 ± 29	-23.7	4050–3980	4230–3960
29789	AC DNG2	Z	20	Surface burial		na	5092 ± 32	-20.5	3960–3800	3970–3790
31164	AC DNG2	Z	20	Surface dung			5148 ± 33	-26.0	4040–3840	4050–3800
30859	AC DNG2	Z	20	Surface dung			5153 ± 32	-25.6	4040–3940	4050–3810
29204	AC9	Z	22	K22/square 7	1.60–2.00	na	5104 ± 32	-19.7	3970–3810	3980–3800
29205	AC10	Z	22	Square 59	0.81–0.91	na	5108 ± 32	-19.7	3970–3810	3980–3800
29788	AC DNG1	Z	22	Bridge profile	(–76 cm below path)	11.40	7128 ± 34	-26.3	6040–5980	6070–5920
29206	AC11	L (lake chamber)	31	Entrance area of chamber	na	na	5213 ± 32	-19.7	4050–3970	4230–3960
29076	AC13/C2	D	14	Middle of section	na	na	5331 ± 31	-28.1	4240–4070	4260–4040
22009	A 480	D	10	Ossuary II	na	na	5195 ± 50	-20.1	4050–3960	4230–3810
22010	A 489	D	9	Ossuary II/context 145	na	na	5193 ± 35	-20.3	4040–3960	4150–3940
22008	A 452	D	10	Ossuary II/context 188/layer 2a	na	na	5272 ± 36	-21.2	4230–4000	4240–3990
22566	A 372	D	10	Ossuary II/context 186/layer 2a	na	na	5275 ± 31	-19.9	4230–4000	4240–3990
22567	A 311	D	10	Ossuary II/context 240–13	na	na	5094 ± 31	-19.4	3960–3810	3970–3790
29209	AC21	A	4	Ossuary I/context 452/square B3	0.72–0.86	na	7192 ± 37	-19.4	6080–6010	6210–5990
22037	A 2073	A	4	Ossuary I/context 475/square D4	0.82–0.92	na	7162 ± 38	-19.2	6060–6000	6100–5930
29203	AC8	A	4	Ossuary I/context 526/square A2–A3–B2	0.83–0.90	na	7246 ± 36	-20.1	6210–6050	6220–6030

The radiocarbon dates have been calibrated using the INTCAL13 calibration curve (Reimer *et al.* 2013), OxCal v4.2 (<http://c14.arch.ox.ac.uk/>) and the maximum intercept method (Stuiver & Reimer 1986).

Calibrated age ranges have been rounded outwards to the nearest 10 years following Mook (1986).

context = omada = excavational group

Table 2.2. Tentative cultural sequence from Trench B1 of Alepotrypa Cave

Phase	Date cal BC	Depth (m)	Comment
FN	c. 4,500–3,200	0–1.20	
FN/LN	(disturbed)	1.20–1.80	includes the single female burial
LN	c. 5,500–4,500	1.80–2.80	
LN	(not secured)	2.80–4.00	interval where depth inconsistency is noted; no secure dates
LN/MN	c. 5,500	4.00–4.30/4.60?	area of the multiple burial
Late EN	c. 6,000	4.60–4.80	area of the adolescent burial

to 1.20 m exhibit a small degree of disturbance and can be dated to the transition from the Late to the Final Neolithic. Finally, the deposits from 1.20 m to the surface are securely dated in the Final Neolithic.

The North Sector of Chamber B, excavated only in its upper part, corresponds to the upper layers of B1, and indeed is actually a continuation of them; accordingly it also dates securely to the Final Neolithic. Ossuary II in Chamber D also is firmly tied to the Final Neolithic, although only its upper strata have been excavated. Earlier dates in deeper deposits also could exist in both areas. Chamber Z and all its niches yielded dates from the Early to the Final Neolithic, but no more refined stratigraphical distinctions can be determined there, due partly to the nature and morphology of the site and to the excavation techniques.

Frequently asked questions and assumptions

Closely tied to the history of the re-discovery and modern exploitation of the cave are two major concerns: first, the amount of disturbance of the deposits inside and around Alepotrypa Cave, and second, the origin of the items collected and transferred to the Museum of Sparta. A couple of other matters that frequently come up in the course of study and the interpretations generated are related to the end of the use of the cave and the location of the original entrance.

Disturbance of the anthropogenic deposits

As mentioned above, the cave remained sealed and undisturbed until 1958, preserving an extremely rare ‘snapshot’ of the last human activities that occurred there in the Final Neolithic, as well as everything that had been accumulated there before that moment. This undisturbed surface and *in situ* condition was lost, inadvertently. It is, thus, very important to rectify possibly erroneous assumptions about this point, and to clarify the degree to which the rest of the deposits were disturbed at Alepotrypa, because although a great volume of deposits was removed or destroyed, another portion, the majority

of the deposits, was, and still remains, undisturbed. More specifically, one can note:

- A) The surface layer of the entire cave, for archaeological purposes, should be considered completely disturbed, although the more remote parts of it are still unaffected. Moreover, of those areas of the cave that were covered by stalagmite crust after its abandonment, any area still incrustated can safely be considered to be undisturbed.
- B) The anthropogenic deposits of the first chamber, Chamber A, were almost completely lost; it was the area that suffered the greatest damage. What was cut away and removed was the west segment of the stratified mound of deposits inside the first two chambers of the cave (Chambers A and B), though it remains in the eastern portion of Chamber B, where Trench B1 is located. The profile of the lost portion is still visible at the cut-line reached: some two metres high at this juncture, called the ‘Petrocheilou profile’. The lowest deposits of Chamber A, below the cement walkways, also were left intact; excavated to the natural cave floor, they correspond, as expected, to the earliest layers of the use of the cave.
- C) The route of the cement pathways was the second most affected area. Although the construction followed natural pathways and corridors, in various points (and apart from the cement layer they built), the workmen had to widen passages, build additional parts, even off a slope, and connect different sections with stairways (either of metal or cement). In doing so, either by digging or with the use of explosives, they destroyed the specific area of the walkways, but usually not the entire depth of the deposit. They did not affect the surrounding areas, as they strove to minimise their intervention. Inevitably though, and as mentioned above, when the workers went about their tasks, they walked all over the surface layer, which should be considered disturbed. The same holds true for the electric cables and the pipe transferring the lake water to the outside. Their positioning destroyed the surface layer where they ran, usually at the furthest edge of the cave, but did not affect the underlying strata, as the cables and pipes were not buried into the deposits.
- D) The Chamber of Lakes also suffered extensive, but mostly surface destruction. In this chamber the construction works involved also the building of low walls in several areas to support the cement walkways and the foundation of the metal bridge and the staircase there. The source-material used for the building of these walls, as well as for the gravel needed for the cement, was the existing rocks on the cave floor, which the workers broke up and reworked according to their needs. The breaking-up of the stones, the major interventions and the debris from the construction processes altered the original picture in the Chamber of Lakes: significant damage to the

anthropogenic deposits occurred wherever work was carried out, either by their being dug up or by being covered with gravel, boulders, paths or walls.

The interventions also involved disturbances to the cave exterior. In addition to blasting an entrance into Alepotrypa Cave, a road was built just outside it, involving major rock removals, in order to provide access to both caves. The construction of this road severely altered the morphology of the mountain and the surrounding area and, also, as it involved the removal of all the pre-existing sediments outside the cave, it destroyed any evidence of the past landscape and any possible evidence related to the original entrance of the cave.

Pre-excavation finds without provenience

With those objects that were found during the construction works in the cave then transported to the Archaeological Museum of Sparta and then, later, returned to Alepotrypa, there are valid concerns about their original context. The great majority of them – pottery, human and animal bones, and tools – most probably were surface finds, but their specific provenience is simply unknown. This material was included in various analyses quantitatively, but was not assigned a secure context or date. In particular, it should be noted that the silver ornaments, claimed to be from the cave, are highly questionable as to their origin; they may come from a completely different site and/or even a different chronological period. Even more dubious are claims of parietal cave art inside the cave, which are certainly fraudulent.

The abandonment of the cave

The end of use of Alepotrypa Cave has been described as happening around 3,200 cal BC, due to an earthquake which sealed the original entrance of the cave, trapping some people inside, who then died and lay unburied on the cave floor. This scenario was suggested by conglomerates of the remains of ceramics, animals, and humans that were discovered on the surface of the cave's fill, all covered invariably in calcium carbonate deposits. Articulated partial skeletons on the floor of the niches can still be seen today in the cave. This is a reasonable scenario which needs however to be verified geologically. There is now possible evidence from the radiocarbon dating for the partial blocking of the interior part of the cave before the anterior, as well as indications for less intensive use of the cave in general after 3,800 BC. It is noted however that the ceramic specialists have observed evidence of material of much later date, though very sporadic in appearance. Therefore, it still remains a pressing research question to define the conditions, the process, and the timing of the end of the use of Alepotrypa Cave.

The entrance to the cave

The original entrance of Alepotrypa Cave during prehistory has not positively been located. It definitely was not where

the present entrance is. The present opening did not exist at all in the past, as this level was buried beneath the deposits: it is the result of blasting away the rock. It was opened after the removal of a large volume of material inside the cave and of rocks and deposits outside, at the top of which the opening (Foxhole) was located. The present situation probably gives a misleading impression. Researchers in this volume discuss activities that could have taken place in this front and better lit chamber of the cave, which probably is not exactly as it was in the past. When the deposits were intact, as traces around the cave walls of Chamber A for the original Final Neolithic level of the cave floor indicate and the undisturbed cave floor in Chamber B shows, this chamber was much less spacious. This area is characterised by an accumulation of anthropogenic deposits starting from the original Early Neolithic floor, at the level of the present walkway, to the Final Neolithic floor, which may have been up to two metres higher. Some information on the original condition of this area comes from: a) the first publication of a map of Alepotrypa by the speleologists who first entered and explored the cave (Figure 2.10) and the descriptions of their experiences there; b) archival photos of the area, before the destruction for the construction of the road occurred (Papathanassopoulos 2011); and c) aerial photos showing the truncated parts of the mountain-side (Figure 2.2). This suggests that another small chamber-entrance existed in front of the present one and at the highest point of it, but it was totally removed as a result of the road construction. The terrain level outside was lowered considerably, and the present entrance was created at that new lower level. This intervention removed the probable small entrance chamber and the associated deposits. It is also possible that the small entrance chamber contained the rock fall expected on the collapse of the original cave-mouth. The mouth was probably very close by, on the same slope, and located towards the present west end of the cave (towards the sea), as the east end runs under the mountain. However this hypothesis needs to be geologically identified and verified.

The recording system

All the findings from Alepotrypa follow the same identification system. First, there is a capital letter, designating the chamber of the cave and/or the letter and number of the specific location (CPI 11). The chambers are A, B, G, D, E, Z, H, L (Greek Α, Β, Γ, Δ, Ε, Ζ, Η, Λ). For example, B/6 means Chamber B locus/area 6, Z/24 (Z24) means Chamber Z locus/area 24, and Θ/14 (Θ 14) or in English TH/Th 14 means locus/area 14 (for the numbering of the locations, see also above). Next follows the number of the ceramic group ('omada'), which is where the find belongs: this 'omada' group number corresponds to a recorded depth at that specific location. For example Z/24/613 reads as Chamber Z, locus/area 24, omada 613. Last, the date of the excavation day follows.

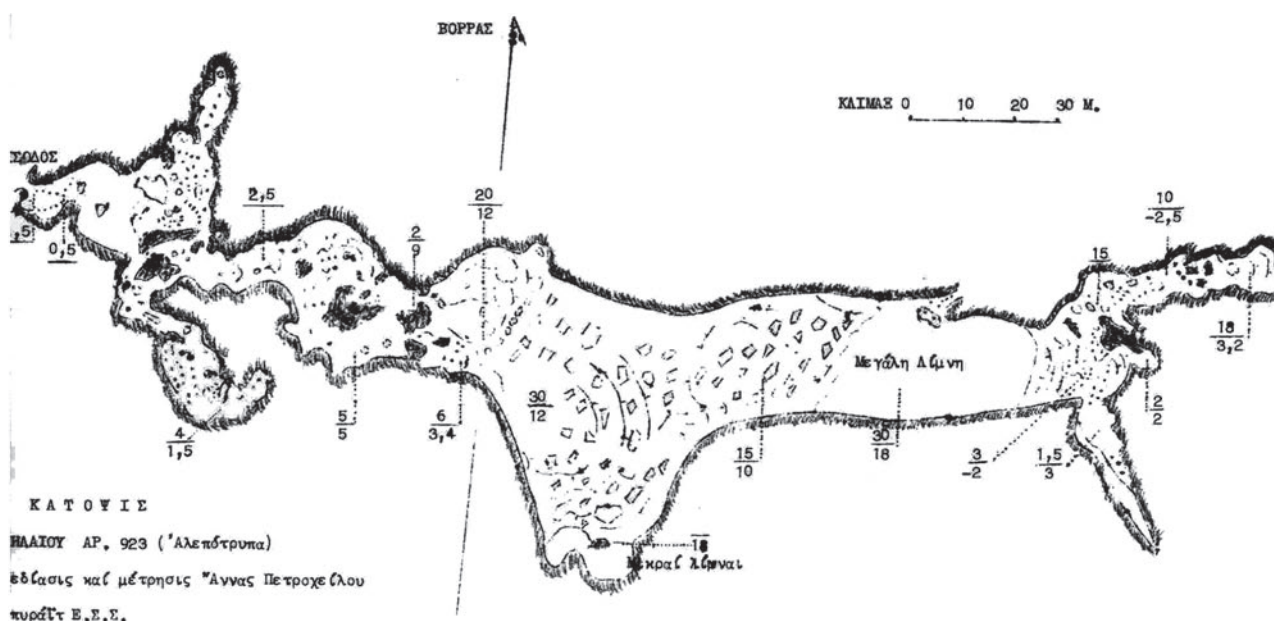


Figure 2.10. Bulletin de la Société Spéléologique de Grèce (IV, Fasc. 7, July–September 1958, insert after p. 112). First map of Alepotrypa Cave (cave number 923) by the Greek Speleological Society. Note the additional small chamber in front of the present entrance.

More particularly, in Trench B1 or in those places where excavation was conducted according to a grid-system, the designation of the grid square or subunit is also recorded. For example B/1E/347 or D/10/FIII/2a (where 2a refers to the stratum). Also in some cases there appear formulae like D/Th11/..., which means Chamber D, locus 11: in fact the first piece of information is redundant, for there is only one Th/Θ 11 in the cave. In other yet rarer instances, the name of the locus can be written as, for example, ΟΣΤ Ι = Oss Ι = Ossuary Ι. Again Z/K 22 is Κόγχη/English Niche 22 in Chamber Z, which could also appear as Z/22 or even Th/Θ 22 (as here the Niche 22 equates to Thesis 22). More complex yet are the cases such as Niche 31: this can be written also as Z/Κόγχη 31/217 (Chamber Z, Niche/Κόγχη 31/omada 217) or even as LA1/217. The last translates as Lake Chamber, locus 1, omada 217: it is identical to Κόγχη 31.

The finds that come from surface collection of the cave follow the same system, but they lack an ‘omada’ (ceramic group) number and consequently a depth. So, terms like Th/Θ 27d, or Th/Θ 46, or Th/Θ 18a all refer to surface finds. All the items returned from the Archaeological Museum of Sparta have only the letter Π on them, which means P for Petrocheilou: they all are of unknown provenience (although a few of them were so distinctive in appearance that they could be identified in the original photos, like pot Δ.770 and skull 0). Finally, ΕΞ indicates an exterior provenience: surface finds from the area immediately exterior to the cave entrance.

A portion of the objects were recorded in three different inventories, referenced as the ‘Diros Catalogues’. Each received a unique identification tag. Every item got a

prefix (a capital letter) and a number: namely A (after Άνθρωπος) for all human bones, Z (after Ζώο) for all faunal material, and Δ (after Διρός) for all other finds. A, Z and Δ correspond to the three different inventories/recording books: each one with consecutive numbering from 1 onward, and with a description of each item entered. About 25,000 items are inventoried in this way in hand-written books; books A and Δ have been converted into Excel catalogues as well. All the rest of the uncatalogued findings bear their provenience information as described above: they number another 100,000 items approximately. The Δ catalogues were further converted from Excel to a FileMaker Pro database.

The present situation

Today the material excavated since 1970 from Alepotrypa Cave, as well as those found in its environs, is stored in the excavation warehouses, arranged by find context. Some of these were displayed in the Neolithic Museum of Diros from 1991 to 2015, when the structure closed for rebuilding. As mentioned in the introductory chapter, an immense effort has been made in recent years to locate and retrieve the massive number of finds and the information that have accumulated since 1970 and translate them into contextual data, the necessary infrastructure for studying and analysing the cultural material, which is presented in this volume. Future plans include the building of a new museum at the site and development of Alepotrypa Cave as one accessible to the public. The latter aim was completed in 2016 by the Greek Ministry of Culture with NSRF and PA funding.

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Bibliography

- Lambert, N. (1971) Fouilles Franco-Helléniques à la grotte d'Alépotrypa. *Archaiologika Analekta ex Athenon/Athens Annals of Archaeology* 4, 199–202.
- Lambert, N. (1972) Grotte d'Alépotrypa. *Bulletin de correspondance hellénique* 96, 845–871.
- Mook, W. G. (1986) Business meeting: recommendations/resolutions adopted by the twelfth International Radiocarbon Conference. *Radiocarbon* 28, 799
- Papathanassopoulos, G. A. (1971a) Σπήλαια Διρού, 1971. *Archaiologika Analekta ex Athenon/Athens Annals of Archaeology* 4, 289–304.
- Papathanassopoulos, G. A. (1971b) Σπήλαια Διρού, 1971. Εκ των ανασκαφών της Αλεπότρυπας. *Archaiologika Analekta ex Athenon/Athens Annals of Archaeology* 4, 149–154.
- Papathanassopoulos, G. A. (1971c) Σπήλαια Διρού, 1971. Αι ανασκαφαί του 1970–1971. *Archaiologika Analekta ex Athenon/Athens Annals of Archaeology* 4, 12–26.
- Papathanassopoulos, G. A. (1996) *Neolithic Culture in Greece*. Athens.
- Papathanassopoulos, G. A. (2011) *Το Νεολιθικό Διρό: Σπήλαιο Αλεπότρυπα*, I. Athens.
- Reimer, P. J., Bard, E., Bayliss, A., Beck, J. W., Blackwell, P. G., Bronk Ramsey, C., Buck, C. E., Cheng, H., Edwards, R. L., Friedrich, M., Grootes, P. M., Guilderson, T. P., Hafflidason, H., Hajdas, I., Hatté, C., Heaton, T. J., Hoffmann, D. L., Hogg, A. G., Hughen, K. A., Kaiser, K. F., Kromer, B., Manning, S. W., Niu, M., Reimer, R. W., Richards, D. A., Scott, E. M., Southon, J. R., Staff, R. A., Turney, C. S. M. & van der Plicht, J. (2013) Intcal 13 and marine13 radiocarbon age calibration curves 0–50,000 years cal BP. *Radiocarbon* 55, 1869–1887.
- Stuiver, M. & Reimer, P. J. (1986) A computer program for radiocarbon age calculation. *Radiocarbon* 28, 1022–1030.

Stratigraphy and site formation processes of Alepotrypa Cave

Panagiotis Karkanias

Introduction

Alepotrypa Cave is one of the few examples of a deep cave that was intensively occupied over its whole extent during the Greek Neolithic. The thick occupational deposits at its entrance chambers, the widespread evidence of use of the interior chambers, and the several burials and ossuaries that have been identified in almost all of its parts provide a unique case for studying site formation processes.

As noted in Chapters 1 and 2, the cave was discovered by chance in 1958: then a very small opening at the top of the present artificial entrance gave access to its interior. The cave consists of several chambers, some of them at different levels, and ends in a small fresh water lake at the sea level (Figure 3.1). The total length of the cave is c. 250 m. Based on the descriptions of the first explorers the entrance chambers (A and B; Figure 3.2) were half filled with deposits, part apparently originating from the collapse of the previous entrance. These deposits fanned out towards the interior of the chamber. In the 1960s, when the touristic development of the cave was first undertaken, these collapsed deposits and apparently the archaeological deposits of a large part of the entrance chamber were dug away. Nevertheless, part of the entrance chambers remained to become the main focus of the subsequent excavations: they preserved a fundamental part of the stratigraphy of the cave.

This present study focuses mainly on the excavated profiles of Trench B1 in the entrance chamber area and a few selected areas in other parts of the cave that preserve intact parts of the depositional sequence.

Methodology

As an integral aspect of wider archaeological study, geo-archaeological research provides the means for interpreting the context of anthropogenic remains (Goldberg and

Macphail 2006). At the site scale, geo-archaeological analysis focuses on unravelling the complex nature of anthropogenic processes responsible for the formation of the archaeological deposits and thus on assisting the understanding of how the space was used.

The present study is based on field observations and micromorphological study of the archaeological deposits. Micromorphology is the examination of undisturbed samples of archaeological sediments under the microscope (Courty *et al.* 1989). The microscope study is based on the analysis of thin sections, themselves produced from resin-impregnated, undisturbed blocks of non-consolidated archaeological and geogenic sediments. Micromorphology is essentially the study of the stratigraphy and sedimentary structure of a deposit at a scale finer than that of field observations. The analysis of the microstratigraphy and microstructure of archaeological sequences and the examination of the relationship between construction features, sediments and their archaeological findings have been successfully used for interpreting the use of space and structure of sites, as well as for deciphering different human activities (*e.g.*, floor construction, dumping, levelling, abandonment, destruction, conflagration, etc.). These processes can be clearly demonstrated from the content and fabric of the sediments themselves (*e.g.*, Matthews *et al.* 1996; Macphail *et al.* 2004; Shahack-Gross *et al.* 2005; Karkanias 2006; Karkanias and Efstratiou 2009; Shillito and Matthews 2013; Milek and Roberts 2013; Karkanias and van de Moortel 2014).

Micromorphological samples were taken from exposed profiles during the excavation seasons between 2010 and 2013. In all, 21 undisturbed blocks of sediment (monoliths) from the archaeological sequence were collected. Finally, 44 large-format thin sections (5 × 7 cm) were prepared and studied. The studied areas include the deep Trench B1, the Petrocheilou profile, and the B3

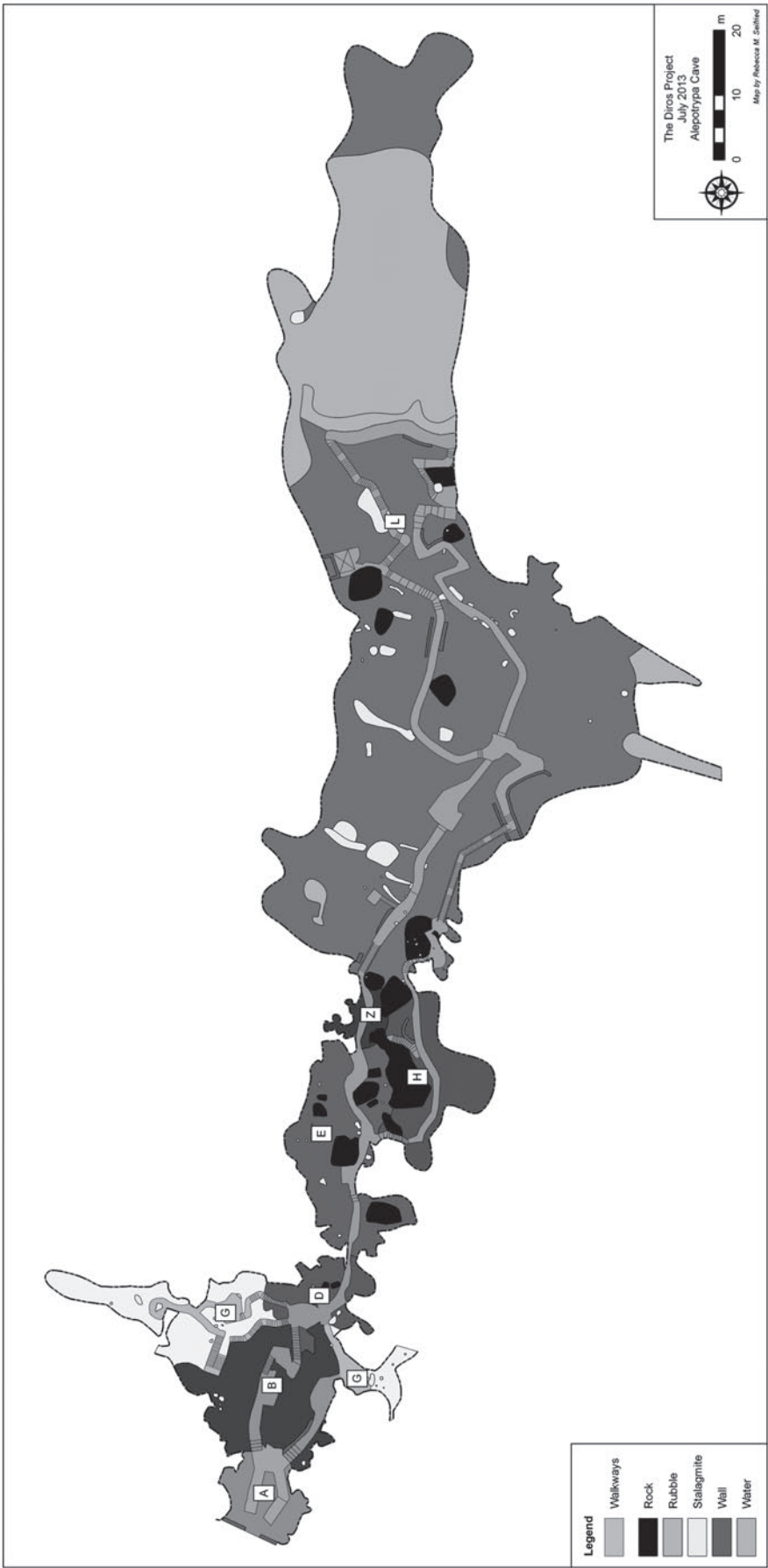


Figure 3.1. Plan view of Alepotrypa Cave, showing the different chambers. Note that Chamber G is partially above Chamber B and that there are unmapped parts of the cave extending along the south side of Chambers G and D and to the east of Chamber L (Chamber of the Lakes) above the lake.

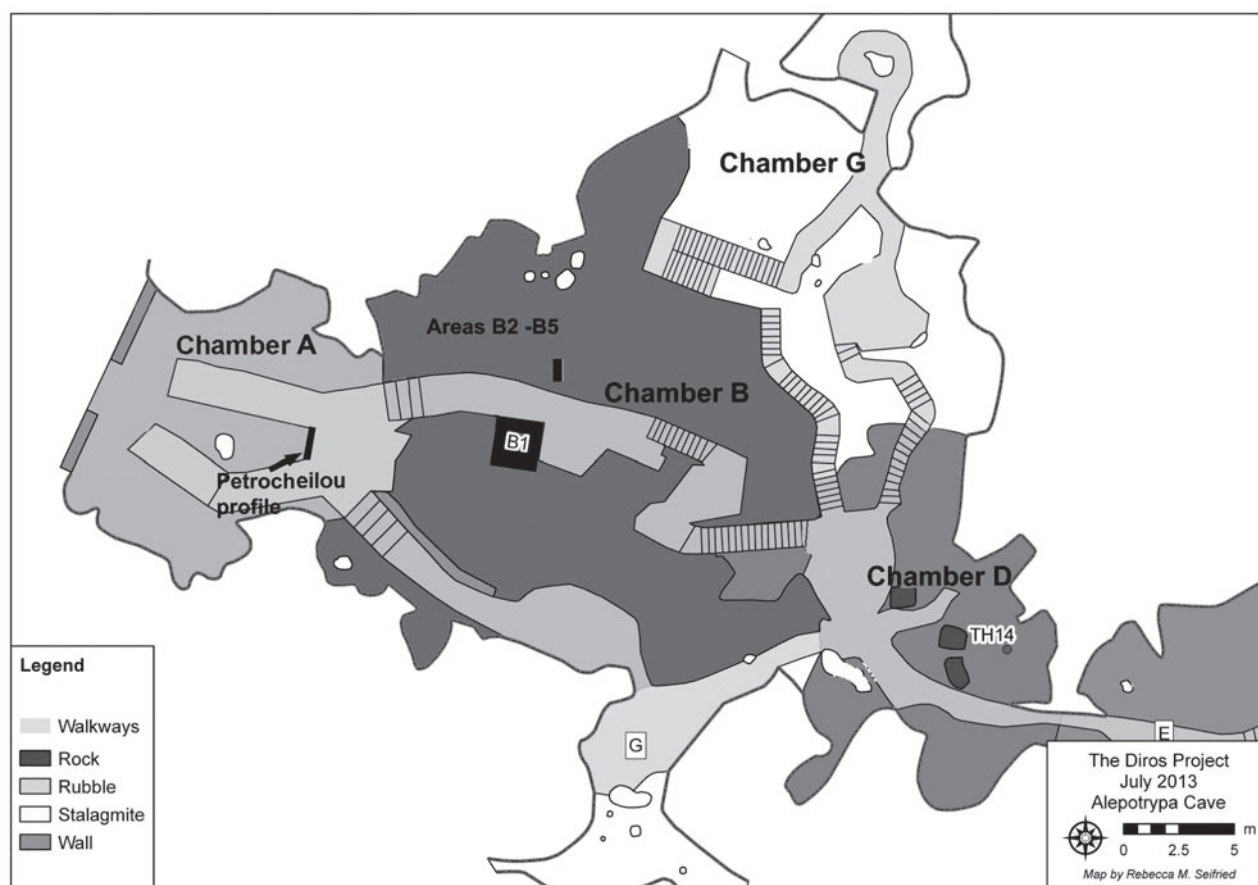


Figure 3.2. Plan view of the front chambers, showing the sampled areas of Petrocheilou profile, Trench B1, areas B2–B5 and Θ (Th) 14.

location in the front chamber, location Θ 14 of Chamber C, and Chamber Z (Figures 3.1, 2 and 3).

Results

Based on field and microscopic observations the following depositional facies were recognised.

Facies A: Constructed floors/surfaces

These are planar bodies of dense, red silty clay, some 1 to 5 cm in size (CPI 12). When not distorted, they are characterised by a crisp linear outline (CPI 13a). Often, they are made up of sequences of layers, each one of a different type of clay, some of which have clear pedogenic features derived from soils around the cave. The layers consist of calcareous silty clay with calcitic nodules or decalcified clay with or without calcareous nodules (CPI 13b). They also can be mixed with charcoal and other burnt remains, or may contain plant remnants in the form of straw imprints. They often consist of densely compacted clay lumps showing various red tones. Some parts are more homogeneous, often with horizons of microscopic striated fabric and a few iron/manganese dendritic nodules. Chambers and channels indicating bioturbation are also observed.

Often the clay constructions have an internal stratified appearance (CPI 13c). Rarely, horizontal deformed calcareous stringers were identified, probably representing ash material not completely assimilated within the clay groundmass. There are also silt intercalations, horizontal alignments of charcoal pieces and more rarely rotational deformation features. All these features imply wet conditions of preparation and application (CPI 13d; Karkanas and van de Moortel 2014).

The types of sediments that constitute most of the above layers are obviously derived from the Mediterranean terra-rossa type of soil located on the limestone terrain around Alepotrypa Cave. These are characterised by an aeolian silt component, calcareous nodules, occasionally striated fabric of the clay and a strong red colour (Yaalon 1997). Red decalcified clays that had infiltrated into the cave might have been also used for the construction of these layers (see below).

The above planar bodies form continuous layers, often running for several tens of centimetres. Given the limited sizes of the trenches, it sometimes is not apparent if they constitute either smaller constructed surfaces or floors covering larger parts of the cave. Nevertheless, in some cases it can be safely argued that they form constructed floor surfaces. Isolated, thinner, clay layers

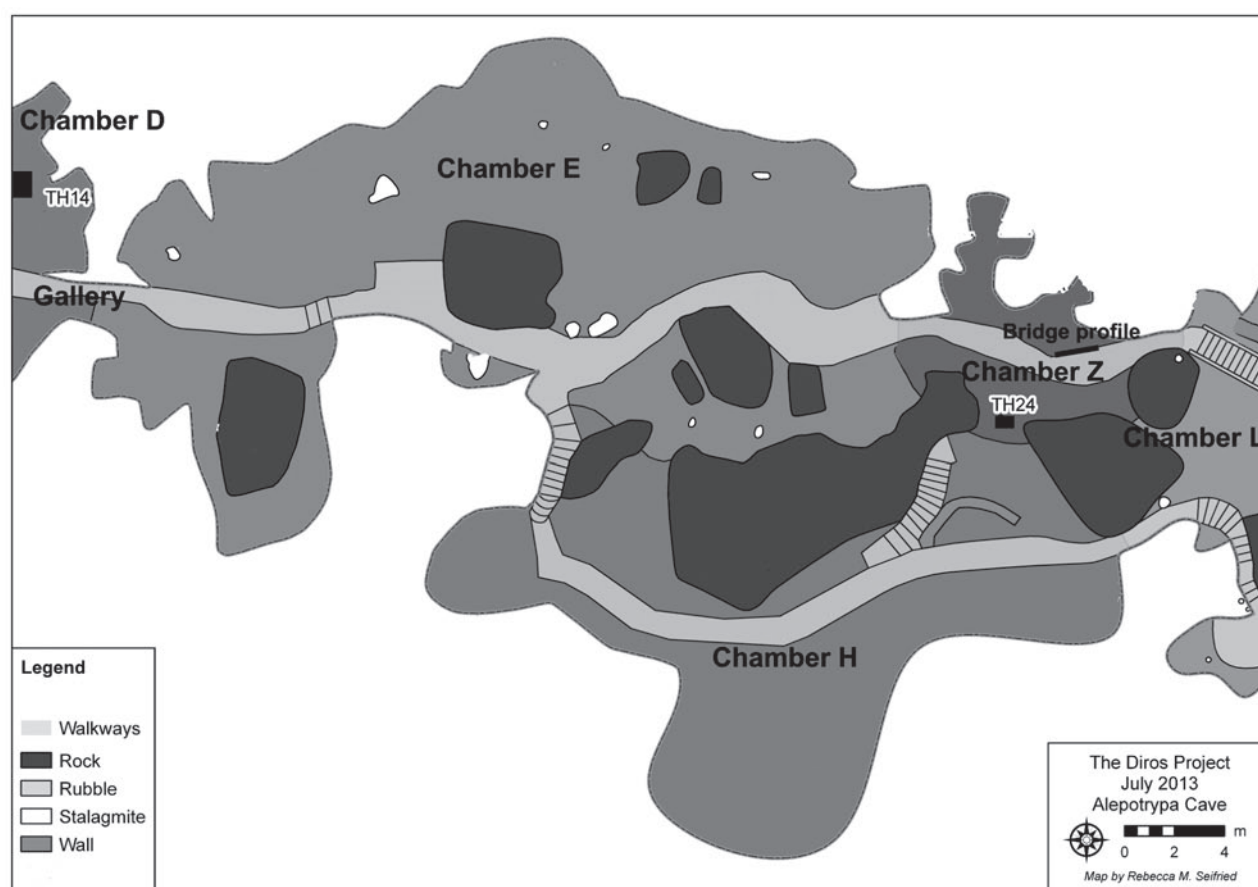


Figure 3.3. Plan view of the back chambers, showing the sampled areas of Chamber Z (bridge profile and Θ (Th) 24).

might represent smaller constructed surfaces intended for working purposes (CPI 14a).

Facies B: In situ hearths

In the field these appear as thin (mm) to thick (several cm) firm white lenses (CPI 12). They often contain dispersed charcoal flakes or are overlain by grey loose pockets and thin laminated layers with charred remains. Under the microscope, calcitic wood ash crystals and ash pseudomorphs (from plant structures) are recognised: these imply a minimum of disturbance and therefore indicate *in situ* burnt remains (CPI 13d). A relatively thick layer of phytoliths has been also recognised in one case at the base of a hearth: it probably represents kindling. Burnt bone was very occasionally encountered. Incipient recrystallisation of calcitic ash is recognised in several cases; hence the firmness of the hearth remains.

Facies C: Burnt dung

In the field, burnt dung appears either as thin lenses, dark grey to olive green in colour, of burnt remains (CPI 14b) or as thick sequences of black, crudely stratified burnt deposits (CPI 15). At a microscopic scale both consist of large amounts of straw-like charred remains, sometimes in a black burnt and undifferentiated compact matrix,

rich in phytoliths (CPI 16) (see also Tsartsidou, this volume). When not decalcified, ashes, oxalates and dung spherulites are also recognised (CPI 16). Some fragments with a convolute, vughy microstructure are occasionally observed, probably the remnants of whole dung pellets once burnt (CPI 16).

The black stratified sequences contain in particular an appreciable amount of a clastic component, intermixed with the organic component and large amounts of pottery sherds. For the most part, though, the fine matrix of the sequence is decalcified and only sand-sized limestone particles survive. Microscopically, it was always possible to differentiate the alternating charcoal and dung-rich layers (CPI 15). Charcoal tends to be represented by whole pieces of the original plant: generally in the range of a few mm in diameter, such probably represents twig material (Ntinou, this volume). Based on several studies of similar deposits and modern enthnographic parallels these deposits most likely represent incompletely (*i.e.*, not reduced to ash) burnt debris from stables or such: this will consist of compact animal dung trampled and probably intermixed with slender fodder traces; interwoven will be layers of small wood branches, kindling for starting the burning of the underlying dung (Macphail *et al.* 1997; Shahack-Gross *et al.* 2003; Karkanas 2006; Shahack-

Gross 2011). Although the dung-rich deposits are for the most part decalcified and therefore their original thickness and appearance would have been considerably different, the mere existence of large amounts of charred branches suggests that they are the product, at least partially, of intentionally smouldering – rather than blazing – fires.

Facies D: Stratified anthropogenic remains

An important type of deposit consists of a crudely bedded mixture of anthropogenic remains interlaced with fragments of red clay constructions, in an overall horizontal arrangement (CPI 14a). The red clay construction fragments have the same appearance, texture and microstructure as described above for Facies A. Often they are discontinuous and fragmented, but can roughly be followed for several tens of centimetres. Thus, they seem to define *in situ* but disrupted, red clay constructed-surfaces (CPI 17). They also bear indications of *in situ* resurfacing. The sediment in between consists of chunks of burnt remains, together with pottery fragments, bone, further lumps of red clay constructions, limestone fragments and fine clastic sediment. Overall, this facies is interpreted as *in situ* but disturbed occupational deposits associated with clay constructed surfaces. Disturbance is attributed to foot traffic and in general to the activities conducted in these areas.

Facies E: Chaotic mixtures of anthropogenic remains

The composition of these deposits is not much different from that of the previous facies, but the sediment is looser and the aggregates and other components have a chaotic structure (CPI 18). Such sediment could be the result of dumping, filling and or levelling processes.

Facies F: Stone layers

These define wedge-shaped or lentoid beds of limestone fragments with relatively sharp profiles (CPI 14c): they may be several tens of centimetres thick. The size of the stones ranges from a few cm up to a score. The clasts are mostly subrounded, implying intensive weathering and a considerable exposure on some surface. They are clast-supported and occasionally show a preferred horizontal orientation, particularly in beds of smaller clast sizes and flatter shapes. Although the limestone fragments are themselves naturally produced by collapse of parts of the roof and the walls of the cave, their organised arrangement and weathered conditions point to filling and levelling processes by the occupants of the cave.

Facies G: Geogenic red clay layers

Thick and massive beds of red clay have been identified in some parts of the cave (CPI 14d). Under the microscope they show clear signs of deposition by water. These markers include microscopic laminations of stringers and pockets of sorted coarse silt with indications of

normal and inverse grading (CPI 19). Flakes of charcoal are occasionally found dispersed in the sediment. The geometry and microscopic characteristics of these deposits suggest the deposition of thick concentrated slurries from clays infiltrating through fissures and cracks in the roof and walls of the cave from the terra-rossa soils above the cave (Karkanas and Goldberg 2013).

Stratigraphy and formation processes

Trench B1

The sediments of Chamber B, part of the front main chamber, form a small mound-like accumulation of anthropogenic deposits near the top of which Trench B1 was excavated (Figures 3.1 and 2). The top of this mound is mostly covered by a thin speleothem crust decorated with numerous small stalagmites generally less than 40 cm high (CPI 12). Below this crust the stratigraphy of the deposits consists of a sequence of both anthropogenic and naturally deposited sediments divided into 15 layers overall (CPI 20). The layers were defined partly on the basis of major and relatively abrupt changes of sedimentary attributes (colour, texture, fabric and overall structure) and by the geometry of their contacts: often a (small or large) depositional hiatus is indicated. These hiatuses have been formed by major changes in anthropogenic activities (*e.g.*, levelling) or natural erosion and sedimentation events. They might also be associated with temporal gaps, although this need not always be so. Layers may contain one or more facies, giving a characteristic overall appearance to the layer that is different from the ones on either side.

Recent excavations reached a burial at some 6 m below the surface. The burial is in close association with lenses of *in situ* burnt remains (facies B). Test coring confirmed that the anthropogenic sequence of the cave continued for about 10–20 cm more and then sterile clays were met for another half a metre, after which the core reached limestone, probably the floor of the cave. The lowest burial in the trench is covered by Layer 15 which consists of red water-laid clays (facies G) with some discrete intercalated horizons of dispersed charcoal pieces (CPI 14d). Some of the charcoal layers originate from thin preserved remnants of *in situ* hearths (facies B), but they are mostly redistributed by natural processes. The preservation of microscopic laminations of water-laid features implies that this area of the cave was not heavily used for the time period of the deposition of these layers. But equally the presence of the thin hearth remains and charcoal layers suggest that some infrequent human presence is nonetheless witnessed. One of the thin hearths has been radiocarbon-dated to *c.* 5,700 cal BC (OxA-31015; see Table 2.1).

Layer 14 comprises the fill of the multiple burial dated to *c.* 5,450 cal BC (OxA-22012 and 22013; Table 2.1) (CPI 21). The fill is a chaotic mixture of

anthropogenic and geogenic components (Facies E: limestone fragments, sherds, bone, charcoal, shell and clay constructed materials). A horizon of stones covers the burial that at its edges gives way to a thick stony layer (Layer 14). This stony layer (Facies G) consists of relatively small sized, mostly platy stones, horizontally aligned (CPI 14c). The geometry and the texture of this stony layer suggest that it is a levelled surface. Although Layer 14a laterally caps the underlying burial, its thickest part is unrelated to the burial. Overlying the stone horizon above the burial is a sequence of red and brown clay constructed floors and surfaces that make up Layer 13 (Facies A; CPI 5). Above the first constructed surface of bright red clay, *in situ* burnt remains were identified containing a lot of burnt shell (Facies B). More burnt remains, but with a chaotic appearance, overlie this in turn (Layer 12, Facies E; CPI 21).

Layer 11 is a mixture of anthropogenic remains including several of stone (Facies E). Towards the entrance, the number of stones increases and gives way to another stony concentration not much different from that of Layer 14a. Hereabouts the two cannot really be differentiated.

Another thin sequence of constructed surfaces of red clay (Layer 10, Facies A), albeit much more disturbed, separates Layer 11 from another, more than a half a metre thick, stony layer above (Layer 9, Facies G). This stony layer has a chaotic appearance with its relatively large stones lying without any particular orientation. It also resembles a construction fill, as its upper surface is quite level. A date of c. 4,900 cal BC (OxA-29275; Table 2.1) has been obtained from this stony layer. Although a difference in date of c. 500 years separates this layer from layer 14 below, a definite break in deposition cannot be definitely supported. First, the intermediate layers of 10–13 have not been dated. Second, Layer 9 and the other underlying stony units suggest that the area underwent several filling and levelling episodes, which obviously have truncated, erased and reworked parts of underlying occupational levels. The large amount of stone might indicate a collapse episode, but their weathered state rather suggests they are connected with an older event or a gradual one. The products of those collapses may have been used by the occupants to clear, drain and level the space for making the area again habitable.

Layer 8 appears to be a mixture of large stones, a few lenses of burnt dung (Facies C) and other burnt anthropogenic materials in a rather overall chaotic mixture (Facies E). However, the presence of undisturbed lenses of burnt dung attests to some integrity in the layer, at least on a local scale. Overall, however, the layer appears to have been levelled, given the arrangement of the stones and the discrete upper contact line (CPI 14b). The nature of the burnt dung layers is not easy to decipher, but their lentoid geometry and the lack of characteristic sequences of *in situ* burnt stabling remains (*i.e.*, regular series of decayed, half-burnt and burnt ash-rich dung layers; Macphail *et al.*

1997) instead suggest the use of dung as fuel in household hearths. Nonetheless, the possibility always remains that these dung layers are the product of ephemeral small-sized stabling activities. In the same way, some of the stony layers may originally have represented the stony pavements met with in stables, as is often observed in Mediterranean caves. However, Layer 8 is capped by discontinuous remnants of constructed surfaces of red clay (Facies A) and the stratified anthropogenic remains of Layer 7. These are obviously the product of domestic activities in the area. Layers 8 and 7 appear to be of the same age as layer 9, but this effect is probably due to the continuous mixing of the sediments of these layers during clearing and levelling processes here. Nonetheless, it also suggests that irrespective of its content the area underwent a serious renovation at about 4,900 cal BC.

The overlying layers, 6 to 2, represent an alternating sequence of stratified deposits: *in situ* but destroyed constructed surfaces (Facies D) and chaotic anthropogenic mixtures (Facies E; CP 14a). These most likely represent alternating domestic occupational deposits and construction fills/levelled surfaces. The timing of this sequence spans the period between c. 4,600 and 3,800 cal BC. It definitely is the most heavily occupied period in this area as suggested by the frequently constructed and destroyed occupational surfaces.

A perfectly preserved clay-lined pit, c. 80 cm deep and 50 cm wide, was also found in this part of the sequence (CP 14a). It was opened from the top of layer 4 and intentionally filled with a chaotic mixture of stones and other anthropogenic material after its disuse. The lining has at least one thin re-plastering, separated from the main lining by a thin beige clay skin. This displays a discoloured halo over the underlying red clay lining; it was obviously formed under strong reducing conditions. Although evidence of organic matter was not identified, such reducing conditions might be the result of decaying organic matter. Therefore, the clay-lined pit might have been used as a storage container for food or similar organic materials. The second lining suggests cleaning and reuse of the pit for another period of time. A similar remnant of a clay-lined pit was found in the lower part of the sequence, its base lying within layer 14. However, its top is not accessible and therefore we cannot define the layer from which it was opened. But given the stratigraphy of the area and the size of similar pits found also in other areas of the cave, the pit might have been constructed at the level of layer 10.

The topmost Layer 1 has the best preserved sequence of constructed clay surfaces of the upper sequence in Trench B1. This thin layer is protected by the speleothem crust and therefore preserves its original features. It could be suggested that this part of the sequence represents low intensity or sporadic occupation. A date of c. 3,370–3,100 cal BC (OxA-29167; 4525 ± 35 BP) was obtained, implying a hiatus of several hundreds of years.

Areas B2–B5

This wide area at the side of Trench B1 was excavated to a depth of c. 50 cm below the speleothem crust (CPI 22). As seen in the excavated profiles and a preserved baulk, the top 30 cm of the deposits comprises a sequence of well-constructed and preserved floors (Facies A) interbedded with *in situ* hearth remains (Facies B; CPI 12). The area is also characterised by two very well preserved clay-lined pits (CPI 22). At the excavated surface of this area fireplaces delineated by ash concentrations are clearly preserved.

Two dates from bones have been obtained so far – of approximately the same age, rounded up to c. 4,000–3,800 cal BC (OxA-29202 and 22011; Table 2.1). The absolute depth of the excavated levels corresponds to Layers 3 and 4 of Trench B1, which also have similar associated dates.

Petrocheilou profile

The Petrocheilou profile is located a few metres from Trench B1 towards the entrance: it shows more or less the same features that were recognised in the upper part of the Trench B1 and the B2–5 areas (CPI 23). Below the speleothem cap, the upper levels consist of relatively well-preserved constructed floors of clay and surfaces that can be followed almost all along the c. 2 m length of the profile (Facies A). Thick, *in situ* hearth remains are visible (Facies B). A date of c. 4,000 cal BC was obtained 35 cm below the speleothem crust in this area (OxA-26359). The lower levels of the profile show more disturbed deposits with huge lumps of clay of several tens of centimetres in size, interspersed inside burnt remains, and horizons of stone with some burnt dung remains. In conclusion, the whole area of Chamber B displays the same types of deposits and similar features throughout.

Θ (Th) 14 location

This is situated in the smaller Chamber D, the first one encountered after the main entrance chamber complex as one moves towards the back of the cave (Figures 3.1–3). A relatively accessible narrow shaft separates the two zones. Location Θ (Th) 14 is a small cavity at one side of this small chamber: a shallow but impressive sequence of deposits was excavated above some human skeletal remains, probably representing a disturbed burial (CPI 24). The burial appears to have been covered with a constructed surface of red clay.

To the sides and above, a thick black burnt layer several centimetres thick was identified. The layer consists of burnt dung-rich remains, that are black and crudely stratified and resemble the burnt dung deposits of Facies C. This layer was capped by a very thin ash layer representing the remains of the wood fire lit on top of the dung remains (CPI 16). Over this is an impressive sequence of layered hearth vestiges (CPI 24): the burnt parts clearly alternate with thin constructed surfaces of red

clay, some of them are well-preserved and some of them are visible only through a microscope as discrete horizons of destroyed clay structures. During recent excavation, further details became apparent: a layer one sherd-thick was found set into the top of each clay surface, on which the fire remains and the hearth proper lay (CPI 24). The last consisted of white ash layers interleaved with charcoal-rich horizons. The ash is mainly associated with *in situ* burnt features and primarily of wood (Facies B). An age of 4,260–4,040 cal BC (OxA-29076; Table 2.1) was obtained from this hearth sequence. The sequence is divided by two massive bowl-like structures of red clay – their purpose remains as yet undefined (CPI 24). Whatever the purpose of this feature, its overall integrity and consistency argues for its very careful maintenance and handling.

Chamber Z

This is the last chamber before the innermost part of the cave, the Chamber of Lakes (Figures 3.1 and 3). Although the area was intensively excavated in the past, a few extant remnants (Bridge Profile; Figure 3.3) give us an idea of the nature of its deposits. In addition, one small test pit was excavated (Θ (Th) 24) and sampled during this second phase of study. The whole area is characterised by an extensive presence of black, crudely stratified and burnt dung-rich deposits with intervening charcoal layers (wood branches): the whole mix being termed Facies C (CPI 15, 16 and 25). In some places the deposits reach a thickness of several tens of centimetres. The same type of deposit seems to compose the matrix in which were found human bone remains in several cavities (niches) hereabouts (Papathanasiou, this volume). More rarely are preserved small lenses of *in situ* hearths (Facies B) and a few small remnants of constructed surfaces of red clay (Facies A). In one case, though, remnants of one of the latter covered several square metres (CPII 5). A date at the base of this sequence corresponds to the earliest occupation of the cave at c. 6,000 cal BC (OxA-29788; Table 2.1). A human bone from the top of the sequence was dated to c. 3,900 cal BC (OxA-29789; Table 2.1). Therefore it appears that the use of this inner part of the cave was continuous for most of its occupation.

The presence of such large amounts of burnt organic remains from animal stables in this part of the cave is rather puzzling, particularly considering their association with human skeletal remains and fine pottery (see also relevant chapters on charcoal remains, phytoliths and human bone and pottery, in this volume). It is difficult to imagine animals actually living in this deep and dark part of the cave: the chamber lies about 80 m from the entrance, and the inclined access (Figure 3.1) includes a small shaft at the beginning of Chamber D and a narrow gallery several metres long and less than one meter high that separates Chamber D from Chamber E (CPI 26). The

latter feature precludes any easy passage of animals, and indeed of humans too, into the back chambers of the cave. Given this, the simplest explanation is that the compacted stabling remains were laboriously transported to the back chambers and reduced on a smouldering fire into charred remains on the spot. The dense mixing of these burnt dung remains with large amounts of fine pottery and their association with probable burial remains (see relevant chapters, this volume) might be tied to some kind of ritual practices yet to be identified.

The abandonment of the cave

The depositional sequences of Chamber B close with the formation of the speleothem crust and the dense stalagmite formations on their tops (CPI 12, 22 and 23). Similar crust formations are found in the other interior chambers as well. They incontrovertibly demonstrate the abandonment of the cave since any serious activity, even wild animal traffic, would have destroyed these delicate formations. This is particularly true for the entrance chambers where the stalagmite formations are still found intact. The U-Th dates from these crusts at c. 2,200 BC (Boyd, this volume) give a *terminus ante quem* for the abandonment. But an actual abandonment by humans could have happened earlier. As discussed by Boyd (this volume) only an abrupt event could have triggered the type of widespread speleothem formation found at Alepotrypa. Nevertheless, a gradual collapse could have effectively rendered the cave uninhabitable before its final catastrophic sealing.

Conclusions

Alepotrypa Cave contains a variety of deposits attributable mainly to human activities but with some from natural processes as well. The front entrance chambers consist of occupational deposits characterised by constructed clay surfaces and occupational debris, mainly in the form of burnt remains and food discards. Some lenses of burnt dung remnants associated with stone-lined surfaces might represent ephemeral and small-scale stabling activities. However, the extensive and repeated clay constructions in the form of floors and large pits attest to the existence of intensive domestic activities in this part of the cave. In addition to the several burials, the frequent reorganisation of the space from filling, levelling and resurfacing activities has caused an intensive reordering of the deposits. The deeper part of the entrance chamber sequence contains undamaged water-laid deposits in between some thin occupational remains: this argues for a less intensive occupation in this area at that time.

The deposits of the interior chambers of the cave are quite different. They are mainly characterised by

extensive and relatively thick dung-rich deposits created by smouldering fires; they are often associated with built clay floors and are very rich in archaeological materials and human bone remains. A meticulously constructed and well maintained fireplace was also identified in one cavity near the front of these back chambers. The burnt dung deposits were introduced here by the occupants as stabling-refuse; they were burnt in the back chambers using thin branches as kindling. Their association with large amounts of fine pottery and probably the burial remains too might have to do with some kind of ritual performance (or some other as yet unrecognised practices; see also other chapters in this volume).

The final abandonment of the cave is probably associated with the total or partial collapse of the entrance of the cave. It is marked by the capping of the tops of the depositional sequences by widespread speleothem formations.

Bibliography

- Courty, M.-A., Goldberg, P. and Macphail, R. I. (1989) *Soils and Micromorphology in Archaeology*. Cambridge.
- Goldberg, P. and Macphail, R. I. (2006) *Practical and Theoretical Geoarchaeology*. Oxford.
- Karkanas, P. (2006) Late Neolithic household activities in marginal areas: the micromorphological evidence from the Kouveleiki caves, Peloponnese, Greece. *Journal of Archaeological Science* 33, 1628–1641.
- Karkanas, P. and Efstratiou, N. (2009) Floor sequences in Neolithic Makri, Greece: micromorphology reveals cycles of renovation. *Antiquity* 83, 955–967.
- Karkanas, P. and Goldberg, P. (2013) Micromorphology of cave sediments. In J. F. Shroder (ed. series) and A. Frumkin (ed.) *Treatise on Geomorphology*, 6, *Karst Geomorphology*, 286–297. San Diego.
- Karkanas, P. and van de Moortel, A. (2014) Micromorphological analysis of sediments at the Bronze Age site of Mitrou, central Greece: patterns of floor construction and maintenance. *Journal of Archaeological Science* 43, 198–213.
- Macphail, R., Courty, M. A., Hather, J. and Wattez, J. (1997) The soil micromorphological evidence of domestic occupation and stabling activities. In R. Maggi (ed.) *Arene Candide: A Functional and Environmental Assessment of the Holocene Sequences Excavated by L. Bernando 'Brea' (1940–1950)*, 53–88. (Memoire dell' Instituto Italiano di Paleontologia Umana V). Rome.
- Macphail, R., Cruise, G. M., Allen, J. R. M., Linderholm, J. and Reynolds, P. (2004) Archaeological soil and pollen analysis of experimental floor deposits; with special references to Butser ancient farm, Hampshire, UK. *Journal of Archaeological Science* 31, 175–191.
- Matthews, W., French, C. A. I., Lawrence, T. and Cutler, D. (1996) Multiple surfaces: the micromorphology. In I. Hodder (ed.) *On the Surface: Çatalhöyük 1993–95*, 301–342. Cambridge.
- Milek, K. B. and Roberts, H. M. (2013) Integrated geoarchaeological methods for the determination of site

- activity areas: a study of a Viking Age house in Reykjavik, Iceland. *Journal of Archaeological Science* 40, 1845–1865.
- Shahack-Gross, R. (2011) Herbivorous livestock dung: formation, taphonomy, methods for identification, and archaeological significance. *Journal of Archaeological Science* 38, 205–218.
- Shahack-Gross, R., Albert, R. M., Gilboa, A., Nagar-Hilman, O., Sharon, I. and Weiner, S. (2005) Geoarchaeology in an urban context: the uses of space in a Phoenician monumental building at Tel Dor (Israel). *Journal of Archaeological Science* 32, 1417–1431.
- Shahack-Gross, R., Marshall, F. and Weiner, S. (2003) Geoarchaeology of pastoral sites: the identification of livestock enclosures in abandoned Maasai settlements. *Journal of Archaeological Science* 30, 439–459.
- Shillito, L.-M. and Matthews, W. (2013) Geoarchaeological investigations of midden-formation processes in the Early to Late ceramic Neolithic Levels at Çatalhöyük, Turkey c. 8550–8370 cal BP. *Geoarchaeology* 28, 25–49.
- Yaalon, D. H. (1997) Soils in the Mediterranean region: what makes them different? *Catena* 28, 157–169.

The stratigraphic and pottery sequence of Trench B1 at Alepotrypa Cave: a first approach to the investigation of ceramic and chronological associations

Barbara Katsipanou-Margeli

Introduction

Alepotrypa Cave lies on Diros Bay, on the east coast of the Bay of Messene, in the southern Peloponnese (CPI 30). Alepotrypa is but one part of the extensive karstic landscape of the Mani, with important traces of human presence from the Upper Palaeolithic to late historic times (Darlas and Michailović 2008; Darlas 2013; Karkanas, this volume, Pullen *et al.* this volume). Alepotrypa Cave extends along a fairly straight east-west axis for c. 250 m, having seven main chambers (A–Z and the Chamber of the Lakes) (Figure 4.1).

After its discovery in 1958 by speleologists Anna and Ioannis Petrocheilos (Petrocheilos 1962, 1965), the cave was intended to become a tourist attraction, and in 1961–1963 construction teams under the direction of the speleologists blasted a large arched entrance in the west front of the cave, removed almost all the fill from the first chamber, and built 500 m of concrete walkways running the length of the cave. They also made extensive use of dynamite to clear rocks within (Papathanassopoulos 1972, 252).

In July 1970 the touristic development work was halted thanks to the intervention of the then Director of Antiquities of Olympia and later Director of the Diros Excavations, G. A. Papathanassopoulos. Scientific exploration of Alepotrypa Cave thus began in 1970 under the direction of Papathanassopoulos (see Papathanasiou, Chapter 2 this volume, for history of exploration and excavation of the cave). The collection of finds inside and outside the cave, alongside the systematic excavation and investigation of the cave, and the study of the material recovered continue to the present day.

Excavations in Alepotrypa Cave have produced a stratigraphic sequence from the end of the Early Neolithic through the Final Neolithic. While excavations have been conducted throughout many chambers of the cave, it is Trench B1 that provides through its depth of 4.80 m the complete sequence of cultural deposits of the Neolithic represented at Alepotrypa. This chapter focuses on the pottery from Trench B1 and its contexts within the stratigraphic framework produced for the cave.

History of the excavation of Trench B1

In August 1970, a meticulous surface survey began in order to record the current situation and discover undisturbed areas for excavation. In the search for a suitable site for a trial trench, interest focused on the second chamber of the cave (Chamber B). This chamber covers a total area of 217 m². On its north side is an extensive cavity (North Section), while the centre of the chamber is occupied by a large mound of anthropogenic deposits (Figure 4.3), now surrounded by concrete corridors.

The mound proved the most suitable site for the first trial trench: it contained extensive deposits over an area of 70 m², undisturbed by the works of the 1960s and covered by a layer of travertine/speleothem crust. It was also located very close to the cave entrance, promising that it had seen a high frequency of use in the past but also would facilitate the excavations. Thus, in August 1970 the first – and so far the only – deep trench was opened, termed B1, with B for the chamber and 1 for the first trench investigated (henceforth Trench B1 or just B1; Figure 4.2).



Figure 4.1. Plan of Alepotrypa Cave with Chambers A–Z, the Chamber of the Lakes and the individual loci of research (white dots).

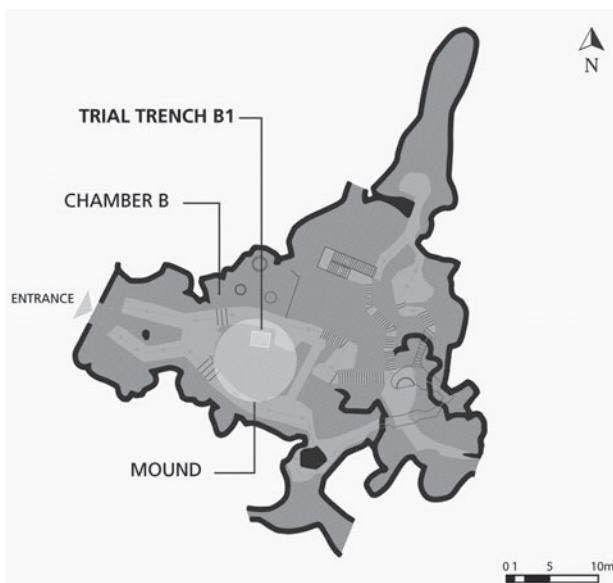


Figure 4.2. Plan of the anterior section of Alepotrypa Cave closest to the entrance, with Chamber B, the mound area and the location of Trench B1.

The trench was placed at the north end of the mound, oriented E–W, and measured 2.75×1.80 m at the surface. It was excavated over 12 non-consecutive seasons (from 1970 to 2013) with long breaks between. The work can be grouped into three phases of excavation: Excavation Period A, the first period (1970), when the greater part of the trench was excavated (from the surface to a depth of 3.02

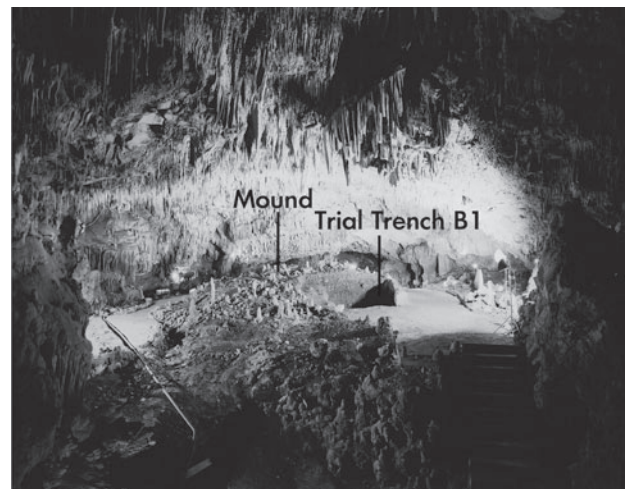


Figure 4.3. Interior of Chamber B, with the central deposition mound covered in travertine/speleothem crust material and Trench B1 during the first year of its excavation (view from the East). (G. A. Papathanassopoulos Archive).

m); Excavation Period B, the second period (1978, 1980, 1981, 1988, 1989, 1992–1994), during which excavation proceeded to 4.10 m; and Excavation Period C, the final period (2006, 2011, 2013), when it reached its current greatest depth (4.80 m). Excavation practices changed between campaigns, greatly affecting the quality of the data recovered. Accordingly, the interpretive worth and analytical usefulness of the material is largely determined by the excavation period from which is derived.

Excavation period A (Surface to 3.02 m)

The first period of excavation is the most important for Trench B1, given the depth of the fill excavated. The excavation was carried out in consecutive horizontal layers, some very thick (up to 0.20 m), a widespread and accepted practice at the time. However, B1, as stated above, is part of an extensive mound, and has a noted slope in two directions. Consequently, excavating it horizontally risked mixing the materials from different layers. In an attempt to solve this problem, efforts were made to match the excavation spits and layers after the completion of the work in accordance with in-situ excavation observations. As a result, the material collected from the surface to a depth of 1.40 m was collated into five strata (S1–S5). This practice was ultimately abandoned, since the existence of small multiple ‘strata’ and the steeply sloping terrain rendered the subsequent matching process too complicated. The excavation was continued in horizontal layers, each layer retaining its material. By the end of Period A nine strata (S1–S9) had been identified, only nominally matched to layers (CPII 34).

Moreover, during the first period the trench was excavated as a single entity, without a grid. Consequently, the horizontal distribution of the finds was only approximate, relative to the sides of the trench and the cardinal directions. These data were entered in the corresponding records of the time, which, however, were later lost (see below).

Another problem in the study and interpretation of the pottery is the mismatch between excavation layers and

actual depth. Specifically, the excavation began at the surface of the mound (depth 0.00) and reached a depth of 4.80 m. However, the depth of the trench today from the bottom to its rim is 4.40 m (*i.e.* 0.40 m less). No loss of depth is noted in the excavation spits. One explanation may be that the length of time between excavation periods in B1 led to the redefinition of point 0, shifting it upwards; unfortunately we do not know in which excavation spits the correction(s) was made and by how much.

Finally, the trench itself grew narrower as it descended, the sides being deliberately given a slight batter to prevent them from collapse. Nevertheless, the deposits were very loose in their make-up: in 1970 the walls of the northwest corner and the south side collapsed. To ensure the workers’ safety, all the walls had to be faced with special fixing material (frigobor, polystyrene foam mixed with plaster), from the surface to a depth of 3 m. This unavoidable solution unfortunately made in situ observation and rechecking of the stratigraphy in the trench sides impossible.

It should be noted that, despite these difficulties – common to many excavations of the time – the material from the trench (although part of it has not yet been located) was systematically counted and stored *in toto*, without being sorted or rejected on any typological basis.

Excavation period B (depth: 3.03–4.10 m)

During this period, the size of Trench B1 was reduced to 2.20 × 1.50 m, and the excavation practice changed, with the internal division of the trench. Thus the trench was

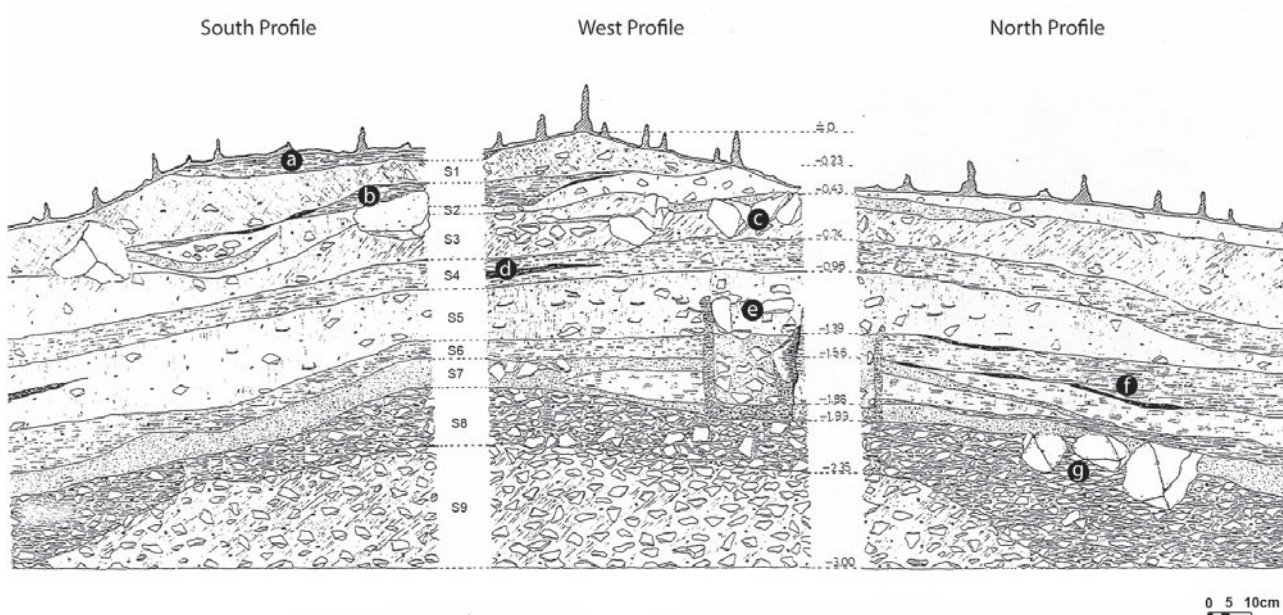


Figure 4.4. Stratigraphy I: The nine layers of Trench B1 (S1–S9) as recorded in 1971. (G. A. Papathanassopoulos Archive).

first (1978) divided into nine areas (A-I) of various sizes and orientations, and then (1980) into nine excavation squares (A-M), each measuring 0.50×0.50 m. The excavation was now carried out using a system of thin horizontal layers (0.05–0.10 m), while more emphasis was placed on the soil composition and the various loci, which occasionally (*e.g.*, beginning in 1989) determined the extent or thickness of the layers. In 1993–1994 the excavation practice remained the same, but an important find, Burial B (see below), led to deviation from the usual practices. The burial was particularly extensive and meant that thicker layers were excavated in ‘peripheral’ squares (small areas outside the grid, towards the edges of the trench, such as A1–K1, Gr370, 371, 498) in order to excavate the area of the burial safely. The material from these peripheral areas is difficult to place in precise layers. The main area of the burial, however, was removed in particularly thin layers and recorded in great detail.

Excavation period C (depth: 4.10–4.80 m)

During the third and final period, the excavated area of B1 was further reduced, to 1.70×1.50 m, as a metal cage was put in place over it to protect against water dripping from the cave roof, with supports also set within the squares to ensure workers’ safety. The excavation was carried out in very thin layers, but now strictly following the direction of the layers: the various burnt and ash layers, the floors and the separate depositional levels were removed separately. In 2011 the excavation was limited to the east part of the trench, using the layer system, but also trial sondages investigated the lowest earths (probably the end of the archaeological fill), as the underlying levels were bare of anthropogenic materials. Thus in 2013 the excavation was limited yet further, to the southeast part of the trench, again removing very thin layers. At the present stopping point (at 4.80 m), and despite the discovery of a new burial (Burial C, see below), the number of pottery and other finds had become significantly reduced, while the above-mentioned sampling indicated sterile underlying layers. Test coring by Karkanas revealed continued anthropogenic deposits 0.10–0.20 m below the last excavated level, followed by half a metre of sterile soil before hitting limestone (see Karkanas, Chapter 3). Thus we may be close to the bottom of Trench B1, though the final depth and the earliest use of the cave remain unknown.

Stratigraphic sequence

1. Sources

a. The records made of the excavation of Trench B1 (diary notes, drawings, photographs and maps) were particularly abundant and carefully documented by the

standards of the time. Unfortunately a large part of this archival material was lost in the 1970s, due to political and other issues. The surviving archival material, though limited and succinct, is still extremely important for the information it provides on subjects such as particular structures, paved floor surfaces, and hearths, which are no longer visible in any face of the trench, at least to their original extent, since they existed within the trench and were permanently removed. The information on the lost archival material is based exclusively on the study of the primary material and the stratigraphy published at the time.

b. In 1971 the stratigraphy of the trench was published, as recorded on three faces (north, west, and south) from the surface to a depth of 3.02 m (Figure 4.4; CPII 34; Papathanassopoulos 1971, 20). The excavator distinguished nine main layers and some intermediate sublayers. This stratigraphy (henceforth Stratigraphy I) is vitally important due to the lack now of other documentary sources, but is not accompanied by any corresponding observations on the layers, structures, or finds, since it was intended to be followed by a detailed publication of the material.

c. In 2013, P. Karkanas carried out an in-depth stratigraphic study of the south and west face, taking 14 carbon samples and creating a new stratigraphy of Trench B1 (henceforth Stratigraphy II, CPI 20; also Karkanas, this volume). This Stratigraphy II covers most of the gaps in the sources, providing an all-embracing overview of the stratigraphic sequence, with extremely important information that in many cases radically alters the previously accepted picture.

Although the details provided by Stratigraphy I may not be complete, the study of the material and structures in the trench has shown that, although older, this stratigraphy is particularly helpful, recording information impossible to reconstruct by any other means today. More specifically it includes records of a further face (the north side), and also the topmost layer of the south face, which are not included in Stratigraphy II, as these details are now lost (the north face is covered by frigorbor, while the upper part of the south face no longer exists, having been excavated away in 1970). Moreover, the stratigraphic sequence was recorded immediately after the end of the first important excavation year, when all the data and actions taken were still fresh in memory. Although some of the elements recorded (such as in the areas of later collapse) no longer exist, they had been drawn. Information missing from the diaries, either because it was later lost or because it was never recorded in the first place, was preserved in an indirect, ‘interpretative’ way in the stratigraphy (*e.g.*, bothros/pit, layer of stones).

The earlier incomplete but primary sources were re-evaluated during the reconstruction of the structures in

the trench presented below. The re-evaluation revealed hitherto unknown aspects of the long and complex history of B1.

This collected information is presented below by excavation layer. In the text, the numbering S1-S9 refers to the layers of Stratigraphy I (as given in 1971), and the numbering L1-L15 refers to the layers of Stratigraphy II. The plan of Stratigraphy I (Figure 4.4; CPII 34) contains additional explanatory notes on the deposits and structures, indicated by lower-case Roman numerals (a–g). Relevant diary entries are provided in inverted commas.

2. Sequence of layers and structures in Trench B1

The depths mentioned below only refer to the spot depth of the beginning and end of each layer, as recorded in the west face of Stratigraphy II (Figure 4.4). They form a conventional point of reference in order to follow the sequence of layers afterwards. However, the exact profiles and maximum depths of the strata, which differ widely in places, are precisely rendered in the relevant stratigraphies (Figure 4.4; CPII 34; CPI 20). The presentation that follows is in reverse, in the sense that it is that of the progress of the excavation, namely from the surface downwards, rather than according to the chronological progress of the formation of the layers. This is done to provide a better understanding of the scanty surviving information on how the excavators viewed the situation as each layer was revealed, and of their interpretation of it.

The first layers (B1a, S1 and S2 according to the excavator, corresponding to L1 and parts of L2) are the topmost layers of the trench. All were covered by a thick layer of travertine/speleothem crust, deposited after the permanent abandonment of the site, and appear to have enveloped clear traces of use (fires, hearths, ash layers). The pottery material from these layers is typical of the end of the LN IIb (Final Neolithic)¹ but is of a greatly reduced volume (compared with what lies below), confirming the hypothesis of low intensity or sporadic occupation in the upper layers (see Karkanas, this volume).

Stratum B1a: First of all, it should be noted that due to the mound's profile, the surface of B1 was steeply sloping, with the west side half a metre higher than the east. Thus only the higher west side was excavated at first, until the trench acquired a uniform depth. This sector was not given a separate stratum number and only part of it is included in Stratigraphy I (Figure 4.4; CPII 34, locus a), while it is altogether absent from Stratigraphy II due to the removal of a large part of the south face (0–0.65 m) in 1970. The earth was 'muddy' and bright red in colour

with occasional grey areas; it contained local fires and strong, extensive traces of ash ('extensive fire'). It was considered to be undisturbed.

Stratum S1 (Depth: 0–0.23 m). Stratum S1 began from the west apex of the mound and, according to the excavator, sloped gently to the south only. It consisted of 'muddy' earth, reddish, grey or red with traces of fire in places: the descriptions of which may partly equate to the 'clay surfaces' of L1. It contained specks of charcoal and very few stones, and was termed partially disturbed, although the small surviving piece of the corresponding L1 is stated to have contained intact surfaces.

Stratum S2 (Depth: 0.23–0.43 m). S2 (corresponding to part of L2) also lay largely under a layer of stalagmitic material. It was identified by the excavator on two sides (west and north), and contained a few small stones, pottery and traces of fires. It was not recorded in Stratigraphy II, because it is located on the north side which has been faced with frigobor.

In the south-west corner of the trench between S1 and S2, the excavator found dark grey earth interpreted as a 'small local fire' (locus b), similar to the surface ash layer. This was not allocated a separate layer number.

Stratum S3 (Depth: 0.43–0.74 m). S3 includes parts of L3-L4 which, according to Stratigraphy II, consist of layers with alternating 'domestic occupational deposits and construction fills/levelled surfaces' (Karkanas, this volume). This matches the excavator's picture of S3, where he notes that it contained a great many stones compared to the previous layers, and 'structures' containing sizeable stones. Special mention is made of the structure interpreted as a 'fire', in the north-west corner at a depth of approximately 0.40–0.72 m. This consists of two rows of large rough stones (about 0.20 × 0.35 m, but also larger as we see from the records) with an infill of smaller stones. The lower part was sealed with clayey earth, while strong traces of fire were found both on the surface of the structure and around the fill surrounding it. Part of the structure is visible in Stratigraphy I (locus c; Figure 4.4; CPII 34) and in a rare photograph from the excavations (Figure 4.5, locus a). It is not, however, recorded in Stratigraphy II, having collapsed over time. In the same layer, in the centre of the trench, large rocks are reported (approximately 0.30 × 0.50 × 0.20 m, part of an unidentified structure or perhaps the structure mentioned above), together with smaller stones (part of an unidentified structure), all set on a thick layer of ash.

We do not know which of the pottery from this layer comes from these structures. All we can say is that the pottery material of S3 is comprised exclusively of coarse ware, at least 78% of it from storage vessels.

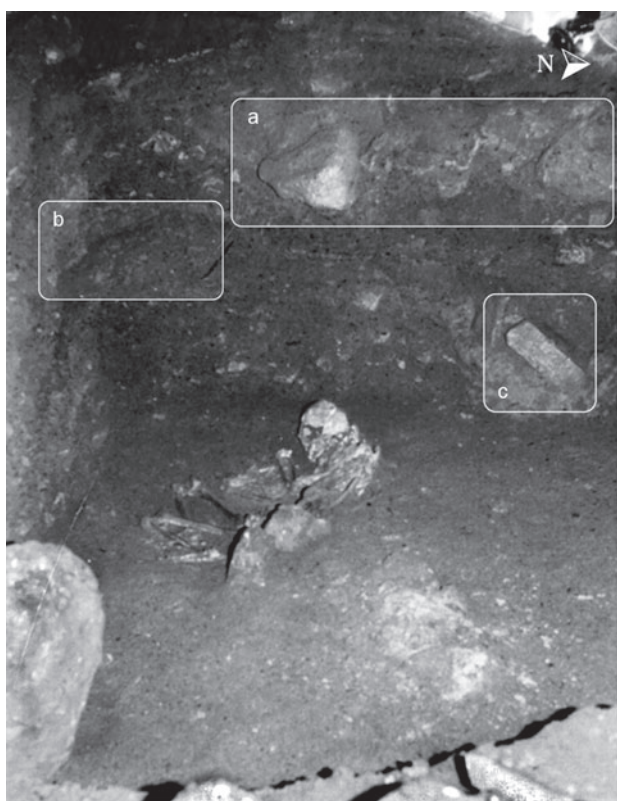


Figure 4.5. Burial A (S7, depth approximately 1.75 m). Locus a: the row of rough stones that formed part of a stone structure ('Fire') is clearly visible. Locus b: area of the extensive 'hearth'. Locus c: area of fallen slabs. View from the East. (G. A. Papathanassopoulos Archive).

Stratum S4 (Depth: 0.74–0.96 m). Very little information on this stratum has been preserved. It is described as not having many stones, and being very 'black' with significant amounts of charcoal. There was a particularly extensive 'hearth' covering the whole of the southwest corner (partially visible in Figure 4.5, locus b, and Figure 4.4; CPII 34, locus d). The pottery still consists solely of coarse ware, over 90% of it from large vessels (probably pithoid vessels).

Stratum S5 (Depth: 0.96–1.39 m). S5 (partially corresponding to L4) is described as a layer of reddish earth, with small stones and traces of grey earth in places. In the northwest corner was an extensive 'pile of stones' which also contained many slab-like pieces (Figure 4.4; CPII 34, locus e). Although there is no clear information on this structure, the slab-shaped stones, are unusual finds in the trench; they may have 'delimited' a specific area, since they were found lying in a row, at the same level, with clean clayey soil both under and around them.

While these stones were being removed, part of the west face collapsed, revealing a clayey pit-like structure, Pit ('bothros') 1. Many stones and quite a few slabs, one particularly large, were found at a depth corresponding to the bottom of the clay-lined pit (Figure 4.5, locus c). As regards

the slab-shaped stones found in situ (Figure 4.4; CPII 34, locus e), their find depth coincides with the lip of Pit 1, and they may be associated in some way with the pit or, at least, the period when it was sealed. The stones were not recorded in Stratigraphy II, as they were all removed in 1971.

The uncovered Pit 1 is a pit 0.80 m deep and 0.50 m wide. The side walls are 0.05–0.08 m thick and the average thickness of the bottom is 0.10 m: its interior was lined with consecutive layers of reddish clayey earth. Another five pits have been found in the cave: the remains of another clay-lined pit in layer L14 of B1 (Karkanas, this volume), two pits in the North Section (north of B1), one in Chamber C, and one in Chamber A which has not survived (Petrocheilou 1965). The pits from places other than the trench are circular, while those in B1 are U-shaped. The five of them share common features: the clay lining, the earth filling, and the absence, according to the excavator, of 'any particular find apart from a small amount of coarse ware'. The find depths of the pits in Chamber B (except for that in L14) indicate that these are roughly contemporaneous structures.

Pit 1 contained two layers in its fill: the upper consisted of 'muddy' grey earth with 'undecorated potsherds' and shells, while the lower, clay layer contained bone and skull fragments, shells, obsidian flakes, a lump of iron ore, a flint spearhead, pieces of baked clay, and 'sherds of coarse vessels'. The pottery was collected indiscriminately from both levels and, apart from a sherd from the leg of a grey pedestal bowl, consists of body sherds of coarse vessels with medium-thick walls, but fewer pithoid jars with applied decoration than in the previous layers. Two samples are coated in a thick layer of travertine.

Pit 1 does not appear to belong to Burial A (see below), as previously thought, since the level of the burial corresponds to the bottom of the pit. Rather the pit goes with a higher horizon that forms part of L4 and must have been reused in a later period, as the second lining of the walls indicates (Karkanas, this volume).

Stratum S6 (Depth: 1.39–1.56 m). Stratum S6 (roughly corresponding to L5 and L6 on the west face) contained very few stones and was thought to be relatively undisturbed. It was termed 'grey' and contained large amounts of charcoal. Indeed, on the north side the beginning and end of the layer are delimited by clear burnt layers (Figure 4.4; CPII 34). There are frequent references to 'areas of tamped red earth' (e.g., Figure 4.4; CPII 34, locus f), which may indicate levelling.

Stratum S7 (Depth: 1.56–1.88 m). Stratum S7 (partially corresponding to L8 on the south face) was described as a reddish-brown layer with a fair number of small stones. In part of the west face and all along the south face, the excavator highlights the presence of 'layers of very bright red earth', which seems to perfectly match the 'red clay constructed surfaces' at the border of L7/L8 (Karkanas, this volume).

An undisturbed single primary burial of a female was found at a depth of 1.45–1.75 m (Burial A, Figures 4.5, 6, and 7; Papathanasiou 2001, 34). Precise information on its structure is lacking. It appears to lie in a burial pit of unknown size, about 0.30 m deep. The bottom was carefully lined with small stones, ‘specially placed by hand’ according to the excavation diary. The deceased had been placed inside it in a contracted position, with the head to the west. The area around the burial is described as being covered with many small stones and gravel, and containing many human and animal bones. In fact, although it is not mentioned in the sources, it seems that something originally delimited all or part of the burial site, as is evident from archival material showing the skeleton’s lower limbs in contact with a ‘row’ of rough stones (Figures 4.5 and 4.7). Moreover, an extensive area northeast of the deceased was occupied by a sizeable pyre (Pyre A), covered with a thick ash layer (Figure 4.7, locus b). On the contrary, the built hearth (Pyre B), later termed a ‘funeral pyre’, 0.30 m east of the skeleton, was found at a lower level than the burial, its relationship to which remains unclear. In any case, when the skeleton was first fully revealed, the built hearth had not yet appeared (Figure 4.7). The archival material repeatedly stresses and links the burial with an extensive ash layer to the northeast (perfectly matching Pyre A, Figure 4.7, locus b) rather than with Pyre B, which contained no traces of ash. The evaluation of Pyre B is still in progress, to ascertain whether it is connected to the Burial in some other way or with something underneath it.

In Stratigraphy II (Figure 4.4; CPI 20), Burial A was identified as the pit-like structure on the west face (locus b), which was opened from a higher level, as shown by its later dating (4,050–3,940 cal BC (OxA-29207; $5,178 \pm 34$ BP)) compared to the dating of the layer (4,550–4,370 cal BC; OxA-29077; $5,656 \pm 30$ BP). According to the records of the time, however, it must be

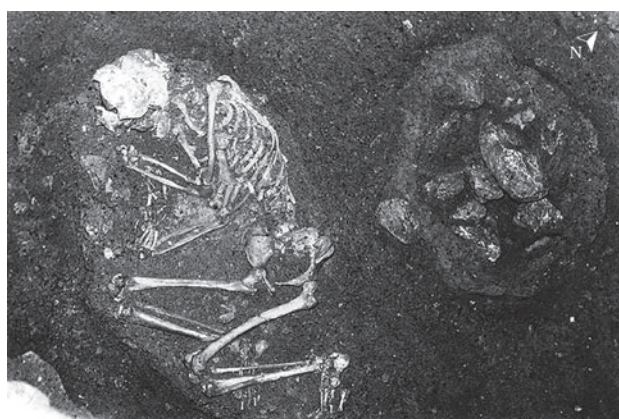


Figure 4.6. Burial A (S7, depth 1.45–1.85 m). The deceased and the circular structure Pyre B with clay walls and filled with stones to the north of the skeleton. No traces of ash are discernible. (G. A. Papathanassopoulos Archive).

stressed that Burial A was not simply limited to this pit. The burial zone widened out within the trench: the body was found to the west, with the area of ‘burial ash’ at a distance from it, while a large part of the surrounding area, carefully strewn with gravel and stones, ‘participated’ in the burial.

Near the skeleton was found a bone tool, teeth, fragments of obsidian cores and flakes, a sherd from the leg of a clay figurine, and a ‘clay anchor-shaped object’ which has not been relocated so far. The pottery of Burial A is similar to that in the rest of the layer. It consists almost exclusively of coarse and semi-coarse ware, with walls of medium and large thickness, together with a few sherds of pithoid vessels with rope decoration. Exceptions are a sherd from the leg of a grey pedestal bowl and a matt-painted sherd, both belonging to wares that had long since ceased to be produced. These are probably intrusive, which is by no means unexpected since opening any pit leads unavoidably to a mingling of material.

Stratum S8 (Depth: 1.88–2.35 m). S8 corresponds to the upper part of stony layer 9. The excavator notes the first significant difference from all the previous layers:

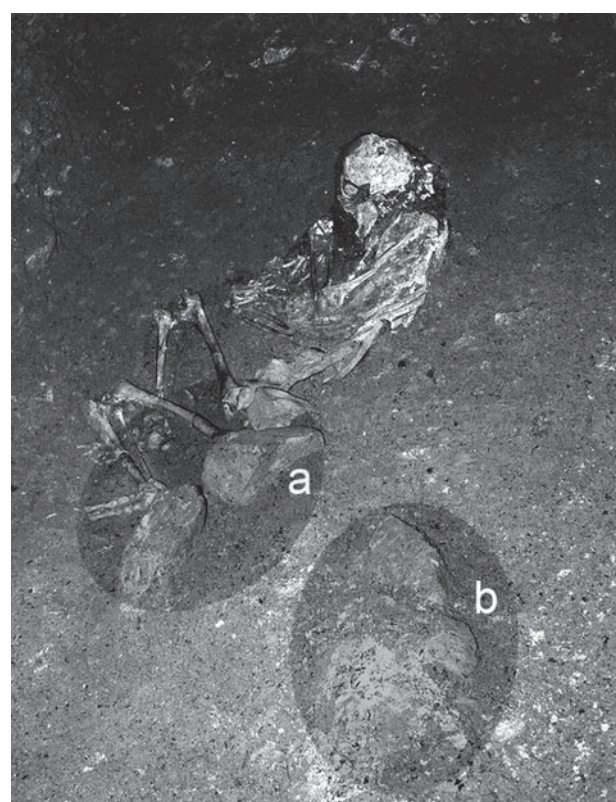


Figure 4.7. Burial A (S7, depth 1.75 m). Main burial layer, with the row of rough stones at the feet of the skeleton (locus a) and the extensive ash area to the NE (locus b, Pyre A). The Pyre B in Figure 4.6 has not yet been uncovered in the burial layer. View from the NE (G. A. Papathanassopoulos Archive).

an extremely large concentration of stones. In the recent study (Karkanas, this volume) it is thought that these stones came from collapse episodes, later redistributed by several filling and levelling interventions. Clues as to these interventions are found in the scanty surviving excavation data: a) on the north face is a ‘particularly large structure’ with at least five massive rough stones (the largest measuring 0.50×0.65 m) extending into the face of the trench (three stones are recorded in Stratigraphy I, Figure 4.4; CPII 34, locus g), surrounded by large amounts of charcoal and strong traces of fire; and b) a ‘circular built structure’ was found in the southwest corner at a depth of 2.25–2.36 m. This must have been a very important construction occupying a large part of the trench, but unfortunately the excavation records for it have been lost; the only evidence remaining is the statement that an exceptionally large amount of pottery was collected in association. The ceramic material (Gr51) includes not only coarse ware, but late matt-painted ware, polychrome sherds, rippled ware and rhyton sherds.

Stratum S9 (Depth: 2.35–3.02/3.10 m). The next layer largely corresponds to the rest of the stony layer 9 (and part of L10). Here the excavator confirms both the collapse episode that created the stony layer and the fact that the users of the cave returned there, rearranging it in various ways, surfacing and using the area. This is the only layer in which stone structures were regularly found. These last consist of: a) in the centre of the north side (2.72 m deep), a group of large stones arranged in a circle, extending into the face of the trench; b) the north side, at a depth of 2.75–3.08 m, was very different to the rest of the area, as it contained large rocks forming ‘special structures’ (not further described), either lying within the trench or extending into the face of the trench; c) in the northwest corner, at a depth of 2.95 m, was a fire (‘Fire I’) measuring 0.15×0.15 m and delimited by stones. Over the stones was a thick layer of ash (5 cm) extending across the whole centre of the trench; d) a sort of paved floor set on reddish earth was found at a depth of 3.05 m, roughly at the centre of the trench; e) in the northeast corner, at a depth of 3.08 m, was a circular stone structure with an outer diameter of 0.50 m and a depth of 0.10 m. The bottom was paved with slab-shaped stones; no traces of ash were found (Figure 4.8).

Finally, two testimonies provide information on the soil composition in certain loci: on the east side, at a depth of 2.80 m, the earth is black and defined as a ‘tamped’ floor with traces of ash excavated separately, while in the centre of the trench, towards the north side at a depth of 2.70 m (Gr82), is a thick, extensive layer of deep red earth that seems to correspond to L10.

From 3.02 m down, the amalgamation of the layers as excavated into strata ceases. Henceforth the excavation data provide detailed descriptions of the composition of the layers and the various finds.

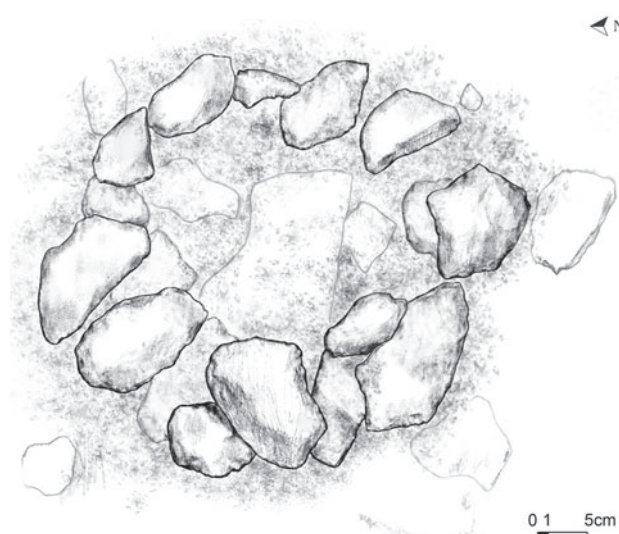


Figure 4.8. Stratum 9. Circular structure in the NE corner with paved bottom (depth: 3.08 m).

The excavators make the general observation that the layer from 3.10 m to 3.80 m contains abundant stones, small hearths or ‘stone’ structures, and slab-shaped stones set around the hearths, while they also note that the quantity of shell and bone falls; the area is generally described as being full of ‘abundant stones’ with sherds wedged between them. It is unclear whether this arrangement is a deliberate one, placed to form a surface or infill. If the latter case, then this seems to occur in specific locations and at indeterminate depths, with interpolated normal and regular ‘usage’ of areas (such as the hearths with the paved floor, 3.60–3.67 m, Sq. E). The descriptions of this layer closely match the thick stony layers L11 and L14a (west front), and would explain the large amount of stones found there during the excavation.

The stones of these layers may again be derived from a collapse episode. If so, then here too the area was subject to refilling and re-levelling, a fact confirmed by the excavators’ discovery of several structures. At a depth of 3.13 m in the south-west corner, where the earth was generally reddish and contained areas of ash and carbonised wood, it was mentioned, albeit in passing, that stones were found in a semi-circular arrangement delimiting a ‘structure’. At a depth of 3.18–3.23 m on the east side of the trench was found ‘Hearth I’. This is a large, roughly oval stone structure of undressed stones, some of them set in a semi-circular arrangement. The interior of the hearth consisted of bright red, clayey earth containing large amounts of charcoal and balls of baked clay, while ‘coarse-ware sherds were wedged between the stones’. It is noted that large amounts of Matt Painted ware (Gr220) were collected from around the structure. Of particular note is the case of ‘Hearth II’ or ‘South Hearth’, a stone (?) structure found at the same depth on the south side of the trench. A large part of it runs back into the trench wall,

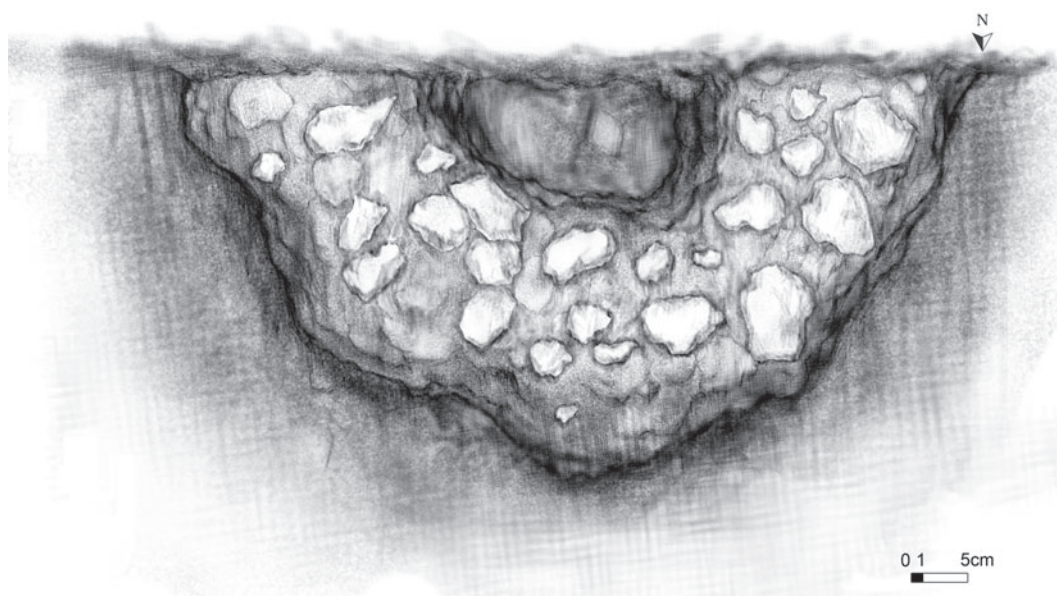


Figure 4.9. Stratum S9. The visible part of the structure on the south side ('Hearth II'), its circumference formed mainly of stones and potsherds (depth: 3.23–3.80 m).

leaving only part visible: a semi-circular arrangement with an external diameter of 0.75 m (Figure 4.9). The exact height of the structure is unknown; it was not removed immediately and was preserved, buttressed by soil, for many years.

When the structure was eventually removed (in 1993), the fill then was about 0.60 m deep; part of it clearly belonged to the underlying layers. The removed fill contained abundant ash and charcoal and baked balls of clay, while dozens of sherds (Gr244, 250, 261, 262) were found wedged between the stones. A large amount of charcoal was found around the hearth, amassed up to its full height; on the west side, at a depth of 3.50–3.79 m, was a special covering of oval pebbles, many of them transversely split.

Finally, in the area corresponding to L10–L14a in Stratigraphy II (Figure 4.4; CPI 20), a large clay-lined pit (bothros) was recently discovered, long after the end of the excavations, during the acquisition of dating samples (see also Karkanas this volume). The pit is U-shaped, approximately 0.90 m wide and 1.00 m deep, and has thick clay walls. It is filled with rough stones, pottery sherds and other materials, as yet unidentified. The structure is currently in the process of being investigated as to its shape, location, and contents, as it is a very recent find. What is certain is that, if this structure intruded quite far into the trench, the east part of B1 is very strongly disturbed.

Burial B. At a depth of around 3.70 m everything changed. An extensive layer of laid stones mixed with charcoal was revealed, marking the start of the layer containing a multiple primary burial (Burial B) (Figure 4.10). Two



Figure 4.10. Burial B, SE corner (depth: 3.70–3.80 m). The skeletons of Burial B begin to emerge directly under the layer of stones. Bones from the Burial were also found within the layer of stones (G. A. Papathanassopoulos Archive).

burials were found: one was in a contracted position and the second was lying prone along with scattered bones belonging to other individuals (Figure 4.11). There are thought to be a total of six to ten individuals, adolescents



Figure 4.11. Burial B (depth: 3.80–3.90 m). The main area of the burials in the east part of the Trench. A single burial with later burials, totalling six to ten individuals, adolescents and adults (G. A. Papathanassopoulos Archive).

and adults (Papathanasiou 2001, 34). To the west of the skeletons was buried a headless and limbless animal (the torso of a sheep or a goat), lying on a layer of charcoal. We do not know the exact limits and full contents of Burial B, since it extends into at least three sides of the trench (north, south and west). It is thought to have originally been a single burial that was reopened to receive newer ones (Papathanasiou 2009, 23). Pebbles, gravel and small stones seem to have played an important part in the burial layer, being used to surround a skull (Sq. K) and the jawbone of a skeleton (Sq. Δ1/462), and to ‘pave’ the bottom of the pit under the skeletons (human and animal).

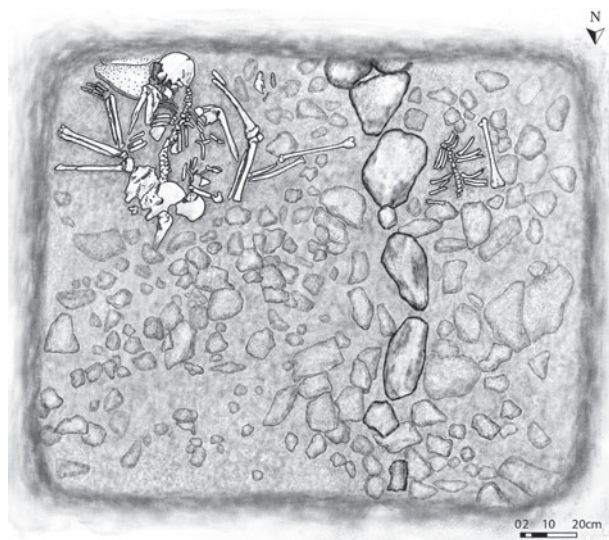


Figure 4.12. Burial B (depth: 3.80 m). Revealing of the skeletons under the layer of stones. The rough stones that ‘separated’ the burial of humans and animal is highlighted.

The burial layer was mostly covered by a thick layer of rough stones. This is indicated by the frequent mention of stones, relatively carefully arranged, directly on top of the skeletons. A very informative photograph of the area (one of the few surviving photographs from its original excavation) shows the layer of stones to be almost touching the skeletons (Figure 4.10). Whatever the interpretation of this layer may be (a ‘sealing’?), it is now evident from the study that the burial was visible when it was laid, as bones from the burial were also found among the layer of stones. However, we do not know whether this affects the whole extent of the trench, and especially not the part of L14a covering the burial (Karkanas, this volume). If the area was reopened for later burials, the exact loci of these interventions are unknown. The observations that the skeletons were covered in places by clear earth or gravel (rather than stones), or that there was no layer of stones on the southeast side, may indicate the sites of such later intrusions, sealed in a different way.

Finally, a careful reading of the few records of the period shows that a long row of well-laid rough stones was revealed during the excavation of Burial B. The row, belonging to the layer of stones, cut transversely across the whole trench and entered the sides (Figure 4.12). This row was then removed to fully reveal the skeletons of Burial B. It appears, however, to have ‘delimited’ the burial (as the human skeletons were only found east of it), excluding the animal burial to the west. If the animal does not form part of another intruding assemblage, then this ‘segregation’ by means of the stones may have taken place at a later date (reopening the area for new burials), when the buried animal was ‘ignored’.

Pottery, food remains, several bone beads, and knapped and ground stone tools make up the main groups of finds in the burial layer. We do not know which of the pottery in the layer, if any, accompanied the dead. All we can say is that a large percentage consists of coarse ware sherds, while no intact vessels or vessels broken in situ – there are very few joining sherds – have been found which could be interpreted as belonging exclusively to the burial assemblage. However, with the help of the excavation diary (since some of the sherds have not been relocated), it appears that at least part of the pottery may have been involved with the burial, given that: a) the skull and part of the body of one of the individuals is clearly placed on top of a large bowl fragment; b) many sherds are in direct contact with the bones; and c) about a quarter of the pottery consists of fine-walled sherds (with a clear predominance of Black Burnished Ware), while some sherds bear careful or particular decoration (painted, Black Burnished, and dot incised, rhyta, etc.; see relevant pottery sections for details).

Under Burial B were layers of charcoal and ash alternating with layers of clay fill, as well as two hearths. One was built of rough stones and pebbles and contained sizeable pieces of carbonised wood. The second (Sq. H) is very interesting, as it consisted of a large pit with a layer of rock chips at the bottom. At least the upper part of the circumference was formed of large rough stones (some arranged in a row). It appears that at the time the hearth was sealed, one of the most distinctive pottery groups of Trench B1 was deposited there, containing large joining fragments – rare in B1 – of Black Burnished ware, early Matt Painted ware, and monochrome Urfinis.

From a depth of approximately 4.20 m, there are striking changes to the area: the west part (Sq. A–E) is covered by a very thick layer of rough stones and pebbles, while the east side contains an ash layer with fewer ceramic and other finds.

To investigate and prompted by these changes, a sampling hole was bored in the east part of the trench in the final excavation year (2013). Frequent alternations of organic sub-layers with pieces of charcoal and layers of clear red clay (L15) were noted, with a decreasing presence of ceramic and other finds, confirming the hypothesis of but a sparse and periodic use of the area in the lower and earliest layers (Karkanas, this volume).

Burial C. Despite this picture of an ‘end’ to productive archaeological layers provided by Trench B1 at this depth, and the negative findings of the sampling holes, a new burial was discovered at a depth of 4.60–4.80 m (Burial C) (Figures 4.13 and 14). This is the primary burial of at least one young individual. On the bent knees of the skeleton were set at least two broken bowls, while to the south was a sizeable pit (0.50 × 0.20 m) containing large pieces of carbonised wood. The burial seems to have been covered

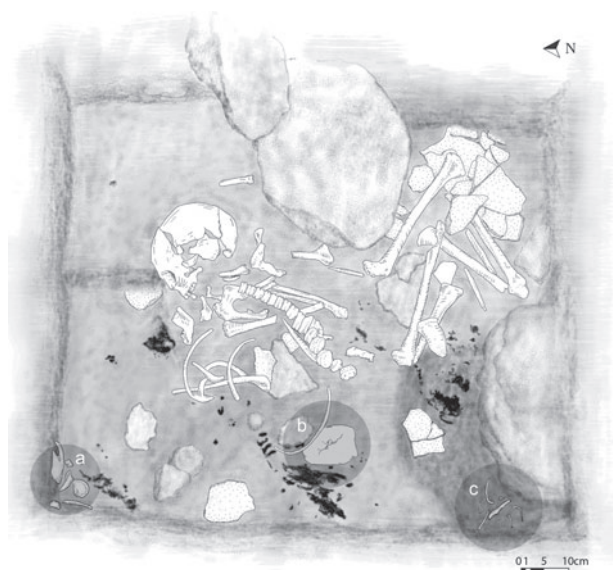


Figure 4.13. Burial C. The main burial, the pieces of charcoal, the location of the pit in the south part of the trench and the partly revealed bones from other skeletons (loci a,b,c).



Figure 4.14. Burial C (depth: 4.80 m). The main primary burial with the skeleton in contracted position. Bowl sherds at the feet of the deceased (SE corner) and bones of later burials in loci a–c (b being a piece of skull) (G. A. Papathanassopoulos Archive).

by large rough stones and a distinct layer of ‘muddy’ clay fill almost devoid of finds. Its precise composition is as yet unknown. Bones of an infant and another individual are scattered around the area, many of them extending into the as-yet-unexcavated east part of the trench and clearly visible, particularly in the northwest and southwest corners (Figure 4.13, 4.14 a,c).

The new sampling holes made under Burial C revealed limestone at approximately 0.50 m further down, probably corresponding to the original cave floor (Karkanas, this volume). If the findings of the sampling holes were to be confirmed throughout the trench, it seems that the

extensive layer of Burial C corresponds to one of the oldest levels of use of the site. However, it is only by continuing and concluding the excavation, taking in the west unexcavated layers of stones and, above all, descending deeper, that we will be able to draw a line, by discovering the first horizon of use of Trench B1.

The pottery

Study methodology and presentation layout

The present study forms part of an ongoing PhD dissertation, certain elements of which are still being analysed.

This paper presents the majority of the pottery found in Trench B1 during the period 1970–2013, with the exception of part of the excavated material which has not yet been rediscovered due to unforeseen circumstances, but whose existence is known from drawings and photographs. Not knowing the exact amount and type of this material, we are not in a position to say whether it might overturn some of the statistical and dating information emerging from our study.

The total number of sherds studied to date is 26,771, of which 4,658 preserve diagnostic features or elements of decoration, while the rest come from the body of vessels or are completely unidentifiable. The main characteristic of the pottery from Trench B1 is its fragmentary state of preservation and advanced wear. The overwhelming majority are single sherds, with very few joining fragments (2%), even fewer preserving the full section of the shape (0.2%) and no intact or fully restored vessels at all. Recognising decorative styles is particularly difficult; we are lucky when the tiny and badly worn sherds found in the trench preserve any decoration at all (see Matt Painted ware). As a result, the statistical analysis and corresponding dating of the decorative styles of such poorly preserved material severely limits its interpretative potential.

The basic pottery groups were first established macroscopically. A large number of sherds (3,200) from all layers were examined with a simple stereo microscope at 20× magnification. Then, 48 samples of seven basic fabrics and wares were subjected to a pilot petrographic analysis. The results are presented in this volume (Penttedeka) and referenced briefly in the pottery sections. The hardness of the sherd material ranged from 2 to 5 on the Mohs scale, while fabric colour was determined using the Munsell scale.

Of the material from the trench, 16% consists of fine ware and 84% of semi-coarse and coarse ware. The four representative categories of fine ware (Black Burnished, Grey Burnished, Matt Painted and Polychrome) are presented here in separate sections. Of the coarse ware, the decorated storage vessels are presented in detail, as is the typology and development of handles and lugs. Furthermore, separate sections are devoted to certain

decorative styles such as rippled/fluted decoration, distinctive shapes such as rhyta and cheese pots, and vessels with typological peculiarities such as rolled rims, all exceptionally helpful in dating the material from Alepotrypa and other Late Neolithic (Final Neolithic) sites. The material which is not presented in detail (*e.g.*, Urfinis, impressed, and incised ware) is recorded in the statistical tables or briefly included in the chronological and stratigraphic overview in the final section.

The classification and presentation of the material is based on the typological and morphological characteristics of the sherds, according to traditional stylistic analysis of pottery groups (category, shape, type). The conventional terminology is also used for vessel categories and types ('rhyta', 'cheese pots', *etc.*), for purely practical reasons: on the one hand they are easily understood by scholars, and on the other it is difficult, within the confines of this paper, to set out the new, though eloquent, objections to the weaknesses of the traditional system that scholars have raised. The descriptions are accompanied by technical observations on fabric, surface treatment, decoration and obvious signs of wear and use, according to case. There follow the find depth data, and the vessels are then compared and contrasted with those from other sites (with the emphasis on the Peloponnesian parallels).

The classification and naming of types and categories (*e.g.*, Red Group, Cream Group, Type A1–A7 for handles, *etc.*) constitutes internal numbering and was judged necessary for practical reasons of recording and clearer presentation of the material.

In order to make the fullest use of the information provided by a trial trench, the chronological and typological development of the vessels from B1 is presented in 43 diagrams (Figures 4.15–58), listing the representative sherds in each category vertically, according to their exact find depth. The sherds were selected on the basis of typological rather than aesthetic criteria. The depth indicator bar on the left side of the chart gives the exact depths of the excavation spit as recorded by the excavators. The typological development does not include sherds from very thick layers (*e.g.*, Gr. 444, depth 3.18–3.81 m), with a very few exceptions referring to the decoration alone. The correlation between the find depth as shown by the depth indicator bar on the left of each figure and the relative and absolute dating is explained in the section on each figure under the subheadings Find Depth/Dating and shown in more detail in the final section of this study.

This presentation is intended to help the reader form a preliminary, general picture of the ceramic dating context; it does not, however, indicate that the upper sherds necessarily come after the lower, since this is an area of intense activity and upheaval, of clefts and pit-like formations. Reservations on the interpretation of these data are repeatedly mentioned in the text, more frequently in areas with greater signs of disturbance, such as burials,

as excavation data presenting an exact picture of the other areas have not been preserved.

With regard to the pottery illustrations, the sherds are presented in section and frontal view. Note that the asymmetry of handmade pottery may result in a certain amount of divergence in diameter. In cases where the opposite side of the sherd is not fully illustrated due to lack of space, the diameter is indicated above by the symbol D=. Where the diameter is not indicated, this means that it was impossible to measure securely due to the poor state of preservation of the sherd. In cases where we do not know which is the right way up, the orientation of the sherd is estimated based on the typological data. Where multiple sherds from the same excavation spit are presented in the figures, they are numbered using lower-case letters (a, b, c) on the right.

The letters Gr/D in the text refer to the laboratory codes of the sherds, Gr indicating the excavation layer group and D (=Diros) being the unique sherd number.

Tables 4.1–4.3 (CPI 27–29) present the quantitative development of fine and coarse wares in B1 in graph form through time. This is a pictorial presentation of their ratios but at relative depths: since the sherds were not found in specific spots but in excavation spits of fluctuating thickness, the data entry programme might lead to slight ‘shifting’ of sherds. The precise data on the findspots are strictly followed only in the text. These tables are useful in providing a snapshot of correlations by period between wares and comparing fine and coarse wares. This quantitative picture includes the relevant information on the ‘intensity’ of use of the areas of B1.

It must be noted that, due to the fact that the ceramic material is under constant study, for some wares not all sherds have been depicted in Tables 4.1 and 4.2 (e.g., Matt Painted, Group 2a), but they are mentioned in the relevant sections of the text.

Black Burnished ware

Black Burnished ware (henceforth BB), a representative and common LN I ware in Greece, is present in Trench B1 with 757 sherds (236 diagnostic), forming nearly 19% of the fine-ware total. Only a very small proportion of these sherds (5%) can be categorised safely as genuine BB (traditionally known as Tsountas type Γ1α [1908] or Wace & Thompson Γ1a1–3 [1912]), as they are the only examples with fine walls, highly polished surfaces, hard-baked cores and a relatively even and deep black surface colour. In the rest of the material, the surface colour varies from deep black to grey or grey-black, or is blotchy: such differentiations are related to the difficulty in controlling an open firing. The black surface colour is attempted either through simple smudging, the practice of covering the pots and the flammable substance with materials such as earth, damp seaweed or dung, or by the more demanding and prevalent method of reduction firing, involving both the final firing stage and the cooling phase after firing proper

(Vitelli, 1999, 26), techniques particularly common in the Peloponnese (Bonga 2013, 173).

The gradations in surface hue differ so greatly from true black that it poses one of the major problems in studying BB ware. The question is how may one differentiate between Black and the relatively similar Grey Burnished wares, given that they share several technical features and shapes. The problem is merely exacerbated when dealing with small, damaged sherds. This fundamental difficulty has understandably led to the study and presentation of the two categories as a single group (e.g., Douzougli 1998, 60–88; Sampson 2008, 89ff.). In the case of stratified material, however, as in Trench B1, a comparative study of the few sherds presenting characteristics of the first (Black Burnished) or second (Grey Burnished) category is extremely rewarding. Thus, in Trench B1, there was an attempt, although with reservations, to divide the sherds inclining more clearly towards one of the two wares accordingly, while the rest of the sherds, with less distinct or strongly divergent characteristics, were placed in the general category of Black-Grey Burnished ware.

Fabric

All of the Black Burnished ware from B1 is made in a medium-grained fabric with cores of varying colour (black, grey and reddish-brown) and generally moderate fracture (hardness 2–4 on the Mohs scale). A high proportion of samples present relatively uniformly coloured cores, either grey to dark grey or black, whereas 10% have dark brown cores, possibly indicating an oxidising or mixed atmosphere (Kyriatzi 2000, 92). A high percentage of pedestal bowls has two-tone indistinct cores, black on the surface and brown or grey on the inside, with a much lower proportion of sandwich cores. Purely uniform black cores are observed more frequently in fine-walled vessels, but distinct two-tone cores (black on the outside and grey on the inside) were only found in highly burnished, fine-walled sherds. The surfaces are relatively carefully polished with medium burnishing, in some cases leaving visible burnishing marks, but traces of high burnishing with the glossiness preserved only survive in approximately 7% of the material.

Macroscopic examination and the use of a stereomicroscope at 20× magnification allowed us to identify seven main types of BB. Twenty-three representative examples were also examined under a polarising microscope and subjected to refiring tests in order to arrive at a precise determination of the fabrics and the local or other origin of the clay (Pentadeka 2005). Six main fabrics were identified: two are ‘highly compatible with local geology’, three are probably of local origin, while for one the closest source is the Gytheion area. Three samples of BB ware used in additional testing in 2013 are of the ‘common fabric’, the most popular for making a wide range of shapes and wares, used throughout the Late and Final Neolithic (Pentadeka, this volume).

Shapes

The range of shapes is fairly limited, with a clear preference for vessels for offering and consuming food (59% pedestal bowls, 22% carinated bowls, 10% shoulder bowls), with very low percentages of possible storage vessels (such as large jars, 2.5%), and almost no drinking vessels (0.5%); the remaining 6% accounts for the rest of the vessels, usually wide-mouthed.

A. The predominant BB vessel type in Trench B1 is the pedestal bowl (conventionally termed a 'fruitstand'), perhaps the most representative of the 'open food-display vessel' category (Figure 4.15). The diameter ranges from 25–40 cm, reaching 50 cm in a very few cases. Pedestal bowls first appear in Trench B1 at a depth of 4.19 m, increasing significantly from 3.80–3.40 m, and cease at 3.24 m. No example has a handle. They often have mending holes, indicating the special value of the vessel.

The capacity of the main vessel and the height of the pedestal dictate the basic variations. The representative typology of the pedestal bowls rims according to their exact find depth is presented in Figure 4.15. Unfortunately, much of the published material from other sites lacks stratigraphic data, making it difficult to compare early and late features.

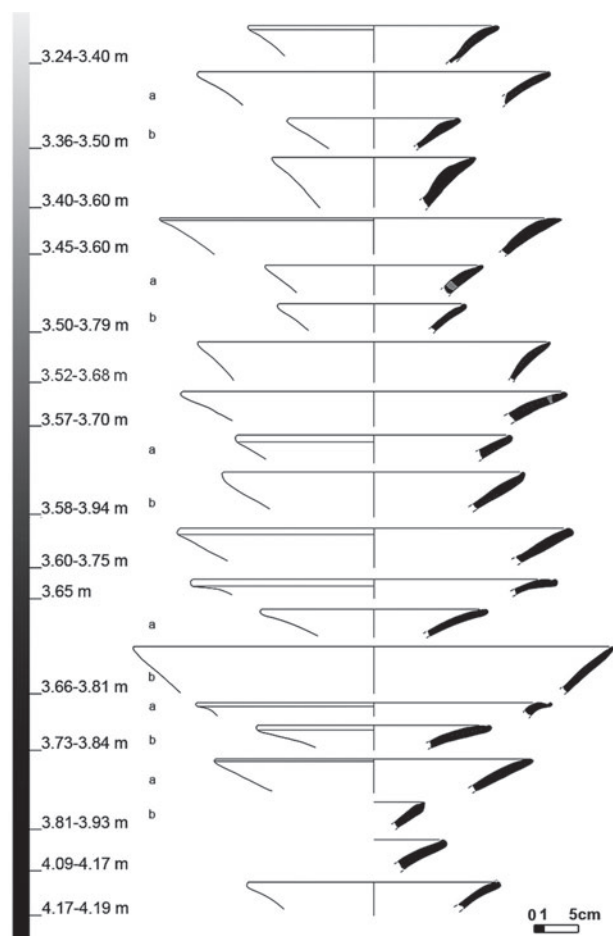


Figure 4.15. Black Burnished rims of pedestal bowls. Form development and find depth (3.24–4.19 m).

However, certain interesting general characteristics may be drawn from the comparison below, albeit subject to many restrictions due to possible disturbances of the area and the material in the relevant strata (see Papathanasiou, Chapter 2 this volume; Karkanis, this volume).

Many of the pedestals from B1 preserve straight outer walls, even in the late examples. A distinctive exception is that with two drooping rims (depth: 3.65 m, 3.73–3.84 m, *a*, respectively), a type mainly found in Grey Burnished ware (Phelps 2004, 74, 77). Most pedestal specimens have a horizontal groove or incision below the rim, a common feature of most examples of the type from other sites. In B1, the early examples always have a rounded lip, thick or thin, while in some later examples, at a depth of 3.40 to 3.60 m, the lip ends in a sharp edge. Bevelled lips (depth 3.81–3.93 m, appear to be very early in B1 and are not found in later phases, although late examples are found elsewhere. Rims without a swollen lip seem to be very early, matching the earliness of the type at other sites (Phelps 2004, 71). Finally, the type with protruding outer wall under the rim groove appears to be a diagnostic Black Burnished type in B1, appearing more often in late examples; it is not found in Grey Burnished sherds.

The bases of most pedestal bowls have a flared upper end (Figure 4.16), with a few steep-walled examples. The

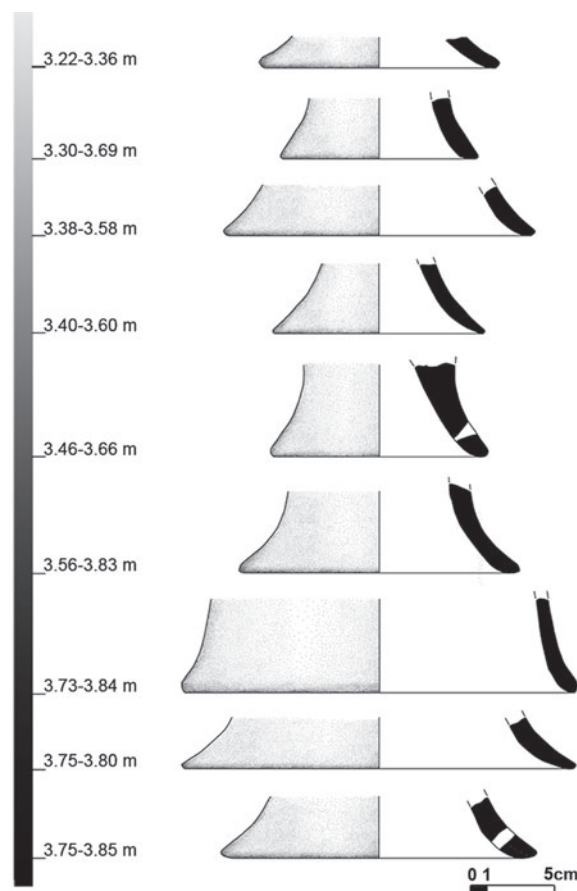


Figure 4.16. Black Burnished bases of pedestal bowls. Form development and find depth (3.22–3.85 m).

usual diameter is 13–20 cm, but there are sherds with a base diameter of 29 cm.

B. Carinated bowls (Figure 4.17) are the second commonest vessel type; they appear a little earlier than shoulder bowls (4.11 m), but continue longer (2.80–2.92 m). The diameter ranges from 12–24 cm. The examples with a well-preserved profile indicate a relatively sharp carination and a fairly straight lower wall, characteristics which are considered more typical of Grey Burnished ware (Phelps 2004, 72). This observation does not appear to apply totally to the Black Burnished material of either Alepotrypa or other sites, such as Corinth (*cf.* Douzougli 1998, note 113). The walls above the carination are slightly concave. Many of the early examples are particularly fine-walled. Certain samples have a handle or pierced lug just above the carination or on the upper body, while the decoration consists of white painted motifs or incisions at the point of carination.

C. Shoulder bowls (Figure 4.18) appear in B1 a little later (3.90 m) and only briefly (3.30 m). All samples bear a bead rim, usually pronounced, regardless of age, which creates a distinctive groove along the rim. The shape is copied in the Grey Burnished and Matt Painted of the cream group in B1. The BB examples from B1 often appear in forms that at other sites are considered more common in Grey Burnished ware (depth: 3.56–3.83 m, Phelps 2004, fig. 31:24) or earlier in date. The type with a more closed shape but without a thickened shoulder, thought to be late (Phelps 2004, 71), also appears among the very early small vessels in B1 (depth: 3.87–3.90 m). The decoration of shoulder bowls consists of oblique plastic strips in the belly area.

The remainder of the sherds come either from shapes appearing in very low percentages (bowls with S-outline), or from unidentified types. There are a few interesting sherds from large vessels (probably jars), some with white painted decoration and mending holes (see white painted decoration below).

Decoration (Figures 4.17–4.20)

Although the proportion of decorated pottery is extremely low (5% of the total BB material), there is a wide range of decorative styles: black or dull white paint, relief with ridges and grooves, incised, impressed, appliqué strips and, finally, dot-incised decoration.

Dull white paint is the commonest BB decorative style in the Peloponnese; nonetheless, it is very limited in the B1 material, with just seven sherds. This low proportion is also owed to the difficulty of identifying them due to poor adhesion of the paint. On some the paint is just a faint trace, while on others the original paint is fairly visible, never glossy and does not react to hydrochloric acid. The decoration consists of simple linear motifs with stacked chevrons, wide vertical bands and oblique converging or parallel lines (perhaps part of the first motif or, just possibly, of a more complex

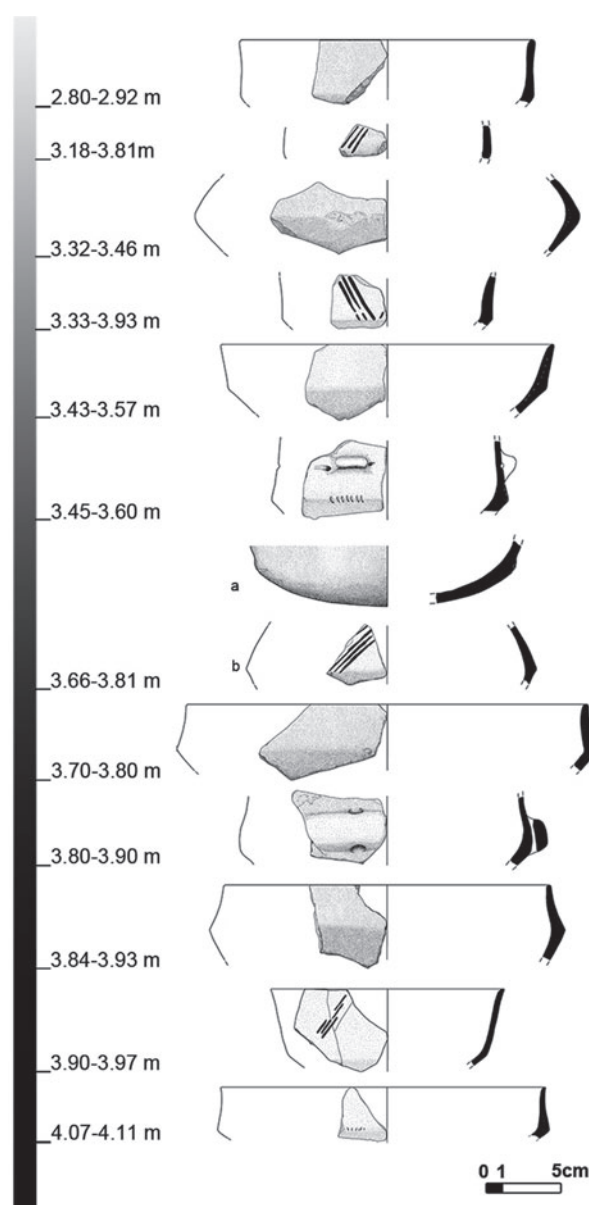


Figure 4.17. Black Burnished carinated bowls. Form development and find depth (2.80–4.11 m).

pattern). The decorated sherds mainly come from carinated bowls (see related sherds in Figure 4.17). An exception are two rare sherds from large, semi-coarse ware vessels, with a group of thick vertical lines (Figure 4.19) which appear on large but thinner collar jars such as in Corinth (Diamant 1974, fig. 3.97; Lavezzi 1978, 439, pl. 111.29), as well as in Franchthi (Vitelli 1999, 28, fig. 10).

White-painted decoration is generally dated to the early phase of LN I and appears to fall out of use after the beginning of LN Ib (Phelps' Late Phase of Period III, Phelps 2004, 74). This pattern also seems to apply in B1, where the sherds with white-painted decoration come from layers of a depth varying between 3.18 to 4.10 m. 'enclosed' by two dates (4,800 cal BC for L9 and 5,100 cal BC for L14). Indeed, some examples of Polychrome

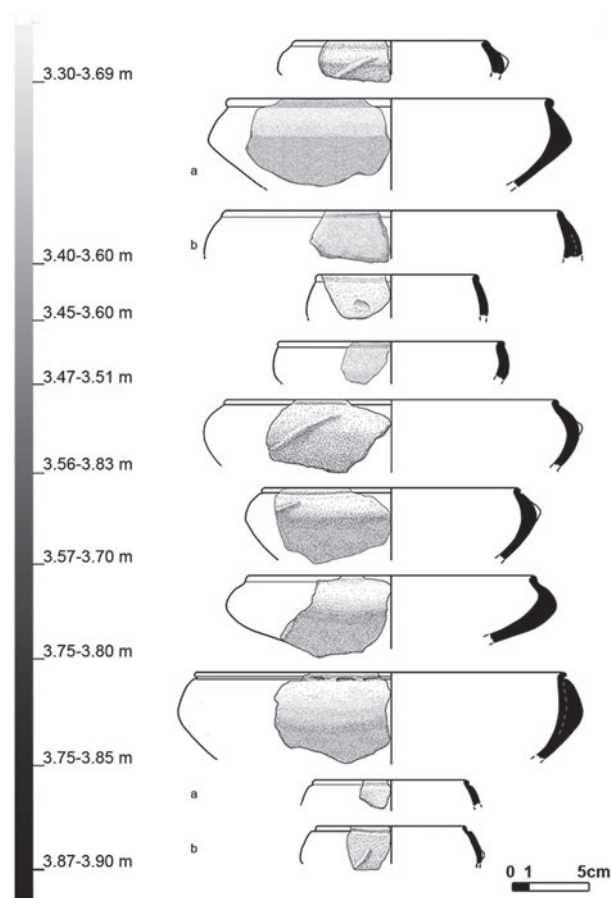


Figure 4.18. Black Burnished shoulder bowls. Form development and find depth (3.30–3.90 m).

ware of the most advanced type (black outline around red) were also found at a depth of 3.45–3.60 m. If these are not intrusive sherds, it seems that Black Burnished with white decoration also makes its appearance in the B1 area at the very beginning of LN I, and ends at the beginning of LN Ib (no sherds of this ware appear thereafter).

Two BB sherds from B1, derived from closed vessels, have a combination of incised and punctate (pointillé) decoration (Figure 4.20). On the first sherd (depth: 2.48–2.60 m), the incisions outline the well-defined dense dots, creating hanging triangle motifs, while on the second (depth: 3.24–3.40 m) the dots are sparser and perhaps more independent in the space, but the precise motif is unknown. Dot-incised decoration, sometimes filled with a white substance, has been found at various Greek sites, such as Pefkakia-Magoula (Weisshaar 1989, 168–170, pl. 29); Kalythies, Rhodes (Sampson 1987, 43, fig. 63.702, 707); Kitsos Cave (Lambert 1971, figs 26, 27, 1972, fig. 13 and 1981, 290–291, figs 172–174); Corinth (Lavezzi 2003, 70, fig. 4.5); and Franchthi (Vitelli 1999, 29, figs 8e, g, 9a-c). Nevertheless, their dating and identification is complex: it is linked to the areas where this type of decoration is found, the ceramic categories and vase shapes to which it is applied, the associated pottery finds and the

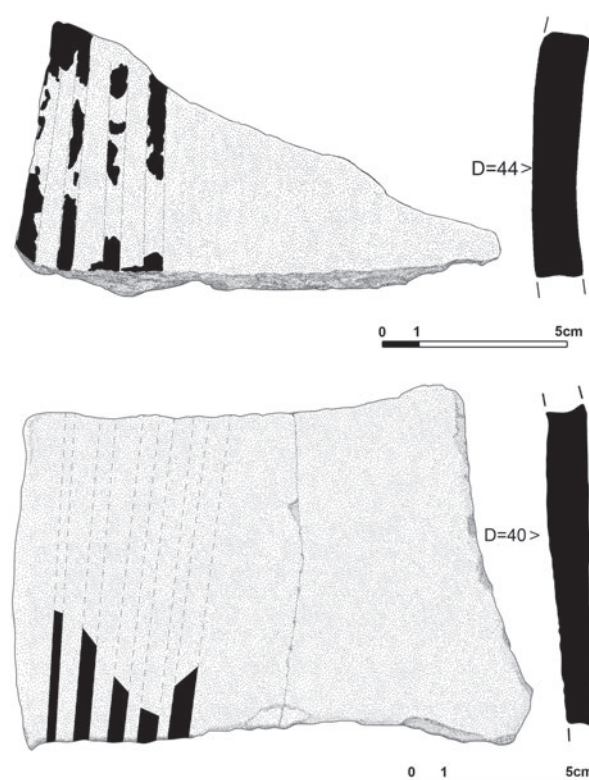


Figure 4.19. Black Burnished semi-coarse ware decorated with white paint (depth: 3.81–3.93 m and 3.65 m respectively).

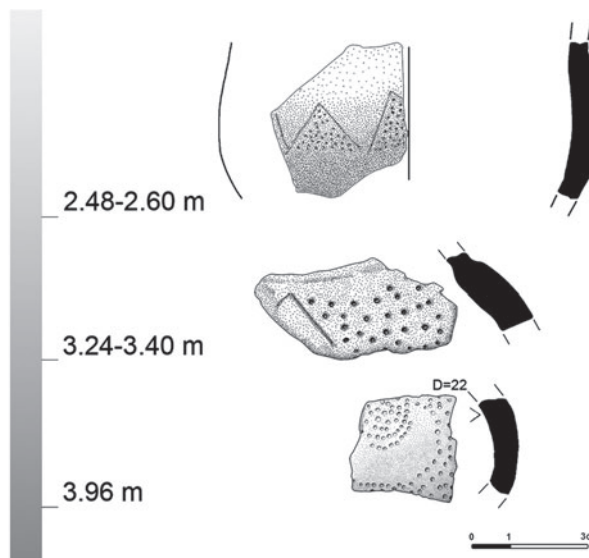


Figure 4.20. Dot incised decoration (depth: 2.48–3.96 m).

rendering of the incisions and dots. Generally speaking, most examples come from semi-coarse unpainted pots with monochrome surface. The incisions are relatively careless and the shapes are varied or specific (such as the scoops), but often unidentified. In Central and Southern Greece this decoration appears mainly as a sub-category of other pottery types (Bonga 2013, 237) such as Black Burnished ware, as is the case with the examples from B1: they are derived from fine-walled Black Burnished

vases and bear carefully executed, deep dots outlined by incisions. Few examples are mentioned elsewhere; only one sherd from Tharrounia, for example, is recorded as belonging to Black Burnished ware and as being filled with a white substance (Sampson 1993, 89), decoration thought to belong to LN Ia.

Generally speaking, dot-incised decoration is dated to LN Ia (Sampson 1993, 89) or LN Ib (Phelps 2004, 103; Lavezzi 2003, 70, 'Corinthian LN III'), with possible morphological differences (Bonga 2013, 239). The sherds from B1 are far too few to contribute to any discussion of chronological or typological identification. They are mentioned here only as evidence of the presence of this ware, considered rare in the southern Peloponnese. The samples from B1 come from divergent contexts. The first sherd was found together with Matt Painted and Grey Burnished sherds at a depth of 3.24–3.40 m and is dated to the end of LN Ia, 4,990–4,780 cal BC (OxA-29275; 5,982 ± 36 BP). The other specimen comes from a higher level (2.48–2.60 m) but is particularly problematic; although absolute dating places it at roughly the same time as the previous specimen, the pottery contexts at this depth are completely different – BB has come to an end, Grey Burnished has decreased by a third and Matt Painted by two-thirds, whereas there is a real upsurge in coarse wares.

It is worth noting, as an aside, that B1 has produced a third sherd: from a fine-walled, very high quality vessel with exceptionally neat dot-incised decoration and a rarer motif, consisting of a spiral central or circular ornament surrounded by a punctated circular pattern. This stands out, as circular patterns are mainly bordered with outlines (*e.g.*, Tsountas 1908, 202, figs 113–114; Evans 1968, pl. xxv). The sherd has a brown surface, belongs to the monochrome burnished type, is dated to very early LN I, and was found in the main layer of the multiple 'Burial B'.

Find depth/Dating

Black Burnished ware appears to bridge the gap between MN and LN, although this is neither clear nor definitive at every site. Nor is the view accepted by all scholars. What is certain, however, is that at all the Neolithic sites of Mainland Greece, in Attica, the Peloponnese and even Macedonia, Black Burnished is always present at the beginning of the LN and characterises it. In the Peloponnese this is confirmed by the definite presence of BB in the early LN layers at the two most important and well-stratified sites, Corinth (Lavezzi 2003, 68) and Franchthi (Diamant 1974, 52; Vitelli 1999, 23–30). Another defining characteristic is its confirmed coexistence with Grey Burnished and Matt Painted wares, and in some cases (such as Franchthi, Nea Makri, Kitsos Cave, Varka Psachnon) with late Urfinis.

It seems that the first certain examples of BB ware at Alepotrypa appear at a depth of 4.00–4.20 m,

corresponding to the very end of MN (around 5,400 cal BC). These sherds have various forms. Some are small fragments of medium-fired clay, with rough fracture edges, not particularly fine walled, and light-coloured surfaces. Others, small to medium, have diagnostic forms (open and wide-mouthed), finer walls, more angular fracture edges and a hard core.

As to the beginning of BB in B1, two further facts should be taken into account, although investigation is still not finalised here, due to the peculiarity of the find location. Some BB sherds were collected from deeper layers along with plain monochrome and scribble Urfinis, but because the area was disturbed by pit-like formations and 'Burial C', the temporal context cannot yet be safely evaluated. Excavation needs to be extended over a larger part of the trench. Furthermore, the Black Burnished of the lower layers includes some quite troublesome sherds, highly polished with a hard-fired, uniform core and true black colour. Most of these are sizeable and joining fragments, which is unusual in the B1 material. Their quality of preservation, size, and clear differentiation from the rest of the pottery material in the same layer all demonstrate that they do not represent early BB in B1, as they bear obviously advanced features. In fact, these Black Burnished sherds were found along with large fragments of plain monochrome Urfinis and a few unexpected samples of Matt Painted ware, *i.e.*, at a depth and time where the former category has almost ceased and the latter has not yet begun. The heterogeneous features of the area are more reminiscent of pit material and possibly indicate a special use related to the burials at the site (see Papathanasiou, Chapter 2 this volume). However, with the site still available for research, it is yet possible that an answer will be found to the questions that the contemporaneous presence of the three wares in the same layer raises – namely as to the beginning and end of these wares and their links through time.

Whatever the case, the first Black Burnished samples are few, increasing significantly in the layers immediately above. Independent of the possible small overlap between Black Burnished and plain monochrome Urfinis, Black Burnished seems to appear more regularly when Urfinis diminishes (around 4.00 m); few examples of the latter are found until a depth of 3.50 m, increasing in numbers after 4.00 m. Shortly after the appearance of BB, the first Grey Burnished sherds also appear in the area of Burial B (around 4.00 m), although they are too few to support the unambiguous appearance in strength of this type. In contrast to the older view that favoured a Black Burnished-Grey Burnished overlap, Grey Burnished appears after Black Burnished at Diros, remaining limited throughout the stratigraphic sequence of Trench B1. As Black Burnished in the trench increases, Matt Painted also makes its tentative appearance alongside it, almost in parallel with Grey Burnished.

The great floruit of Black Burnished ware comes between 3 and 4 m, in LN Ia, a period in which Matt Painted also increases, while Grey Burnished continues with a small but steady presence. It is worth noting the strong presence of Matt Painted alongside Black Burnished ware, originally in very low proportions in the lower layers, but increasing at least threefold during the peak of BB ware. For about 30 cm (3.00–3.32 m), which corresponds to the end of LN Ia, Black Burnished fades out, while Matt Painted continues to predominate with high percentages, and Grey Burnished continues alongside it at its accustomed steady, low percentages. At around 2.70 m (c. 4800 BC), Black Burnished seems to come to an end; very few sherds are found thereafter. The fruitstand sherd at 1.45 m appears to be intrusive.

Rhyta

Four-legged rhyta may be the only Neolithic vases that diverge strongly from the typical ceramic repertoire. In fact, they are actually a peculiar amalgam of vessel and figurine, with the vessel set aslant or completely vertically on four zoomorphic/anthropomorphic legs, and with a large basket handle at its apex. Their main distinguishing feature is the robust legs, with incised or grooved decoration, occasionally filled with white paste in the incisions. There is often red-crusted paint in the grooves at the body-legs and handle-body junctions, inside the vessel and, in some cases, on the handles.

These vessels have been conventionally termed ‘rhyta’ since they were first discovered by Yugoslav archaeologists (Dujmović 1952; Korošec 1952), implying a ritual purpose for the vessels. Over the ensuing decades, rhyta of all vase forms have attracted the largest number of interpretations as to both their possible functional use and their cultural identity (for an overview of basic theories, see Rak 2011; Bonga 2014). At the same time, they have been extensively studied as to their origin and dissemination, being the vessel with the most impressive distribution in the whole Neolithic ceramic repertoire (from the Adriatic coast, central Bosnia and southeast Italy to the tip of the Peloponnese). The excavation data, find layers, and associated finds, alas often absent or unpublished, are of the utmost importance to the twin issues of rhyton interpretation and origin. The case of Alepotrypa is quite helpful in this respect and can be included in the much-discussed provenance study, since for some rhyta we have both the absolute date of the layers and information on the pottery and excavation context.

Alepotrypa Cave has produced six definite rhyton sherds and another two probable fragments. Three (1st Group) were found in other areas of the cave, two of them unstratified; although they do not belong to Trench B1, they are briefly presented below due to their importance. The other three sherds (2nd Group) were found in Trench B1. This group also includes a leg sherd, possibly from a multi-legged vessel.

1st Group (Figure 4.21)

The first two examples were collected by the Petrocheilou speleologists during the construction works of the 1960s and have no indications as to provenance. Both are quite similar to the Elateia type with short, thick legs (Weinberg 1962, fig. 12) and were first published by Phelps (Phelps 1975, 246–247, fig. 61.18 and 19, pl. 102.3). One of the two has not been located. The other (P/D1240) is a solid, squat leg preserving a small part of the body (Figure 4.21a). The surface is highly polished, brownish-grey and decorated with two converging pairs of bands filled with short slanted and criss-cross incisions (hatched and crosshatched motif). The decoration is common on rhyta from Greece and elsewhere, for example from Corinth (Lavezzi 1978, pl. 109.40) and Drachmani and Kakanj (Bosnia and Herzegovina) (Weinberg 1962, pl. 65 a1, 3, 5, 7, 8, 65d). The fabric is brown, fairly solid and contains many inclusions. The third fragment (Figure 4.21b) is a part of the rim and the attachment point of the left leg (as drawn) and preserves external incisions under the rim. The fragment has grey-black polished surfaces and a grey core with few inclusions. The sherd was collected from the excavation of a small niche in Chamber A, where Ossuary I was subsequently discovered. The fill, containing animal bones and a few human bones, is dated to EN and LN–FN (see Katsarou, this volume).

2nd Group (Figures 4.22–4.25)

The second group includes the rhyta of Trench B1.

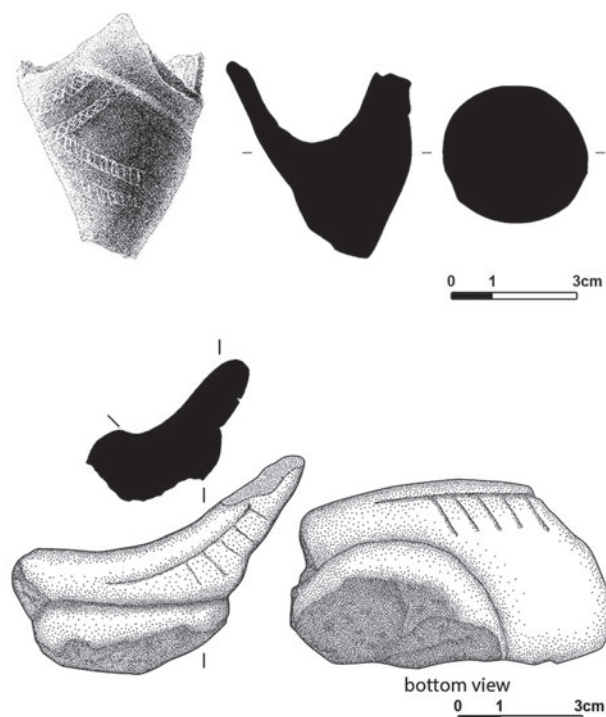


Figure 4.21. Rhyton sherds from various areas of the cave (Group A, a. P/1240, b. A4/13).

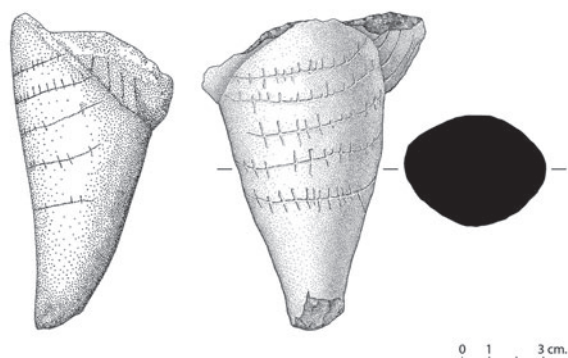


Figure 4.22. 2a. Rhyton sherd (Gr335/D16931).

Rhyton 2a: The earliest rhyton fragment (Figure 4.22) was found at a depth of 3.80–3.88 m (Gr335/D16931). It is an intact, solid piriform leg with a total height of 12 cm, preserving part of the body at the upper end and belonging to the second type, that with taller, slenderer legs. The leg is decorated with a ‘barbed wire’ motif, consisting of five parallel incisions with small transverse grooves, all roughly executed (for parallel motif in a different pattern, see Rak 2011, fig. 29). One series bears a notched motif, with single transverse strokes (Phelps 2004, 86, fig. 61.13 and 15, Archaeological Museum of Ancient Corinth, Prehistoric Collection). The leg-body junction is also highlighted with deep parallel grooves. The surfaces are black, highly burnished and polished in places, while the core is grey-black (10YR 2/1) and hard, with many inclusions also visible on the outer surface. The fragment is chipped on the bottom and has rounded edges due to advanced wear.

Although there is no precise information on its find context, since its identity was not realised at the time, the depth and find square show that the area had a special character. The rhyton is associated with the multiple burial (‘Burial B’). Human bones and pebbles are mentioned close to the rhyton. Although this is a burial, the specific grid square where it was found was considered undisturbed, as the bones were surrounded by an undisturbed layer of pebbles. The pottery associated with the rhyton consists almost exclusively (85%) of coarse ware. The fine ware of the wider layer (3.70–3.90 m) in which the rhyton was found is 42% Black Burnished, 12% Grey Burnished and 46% Matt Painted ware.

Rhyton 2b: The second rhyton fragment (Figure 4.23) was found in the layer immediately above (Gr430/D17356, depth: 3.76 m). It is a piriform, particularly slender leg with shallow incised decoration, also belonging to the tall, slender leg type. The surface is decorated with three wide bands of varying widths bearing grooves of short angled lines in groups (hatched motif). This is a common motif, found for example on rhyta from Corinth (Lavezzi 1978, 109.39; Phelps 2004, 61.17). The surface is greyish-brown (10YR 5/3), highly polished but very

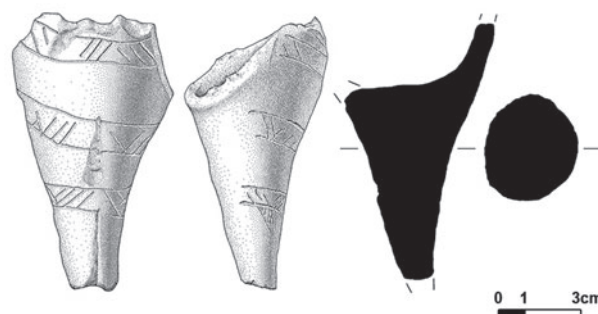


Figure 4.23. 2b. Rhyton sherd (Gr430/D17356).

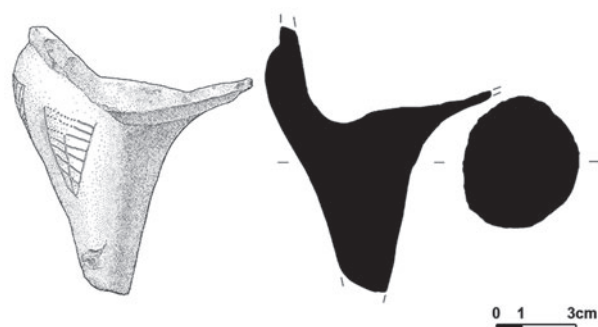


Figure 4.24. 2c. Rhyton sherd (Gr264/D1845).

worn, with deep chips and heavy post-depositional wear at the edges. The fabric, too, is a greyish-brown, hard, with many inclusions also visible on the outer surfaces; it had a relatively even firing.

The rhyton was found on an extensive pebble floor. This floor, of rounded stones or transversely chipped conglomerates, appears to have covered, if not the entire trench, at least the whole of its west part. Its state of preservation was excellent, which is unusual for B1. Directly under the pebble floor began the multiple burial layer (‘Burial B’). The pottery in this excavation sheet consisted of 37% fine ware, of which 78% was Matt Painted (mostly white group), 14% Black Burnished and 8% Grey Burnished.

Rhyton 2c: To the east, in the same layer (3.60–3.75 m deep) was found the third rhyton fragment (Figure 4.24, Gr264/D1845). This is the best preserved rhyton piece from the cave: a piriform, fairly slender, solid leg with part of the hollow body. The surfaces are black, very highly burnished and polished. The fragment is decorated with an unusual motif of three large lanceolate leaves with herringbone incisions. The deep groove stressing the leg-body junction is filled with red-crusted paint. This is the only fragment of a rhyton from the cave to preserve traces of paint. It has a grey-black fabric (10YR 4/1), hard, with numerous inclusions visible on the surface.

No detailed data on the find layer exist, although it was retrieved close to the pebble floor mentioned above, and the two rhyta (2b, c) were probably associated. The associated pottery includes, as in the case of rhyton 2b, fine

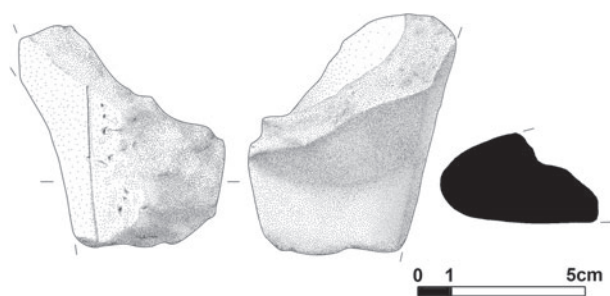


Figure 4.25. 2d. Sherd from multi-legged vessel (Gr51).

ware forming 37% of the total, with an exceptionally large concentration of Matt Painted ware and, above all, Cream group (72%). Similar percentages are also observed in the wider find horizon of the rhyton, which contained 31% fine ware, in which Matt Painted predominates with 85%, Black Burnished makes up 12% and Grey Burnished ware is only present in very low quantities, barely reaching 3%.

Rhyton 2d: The case of another fragment (Figure 4.25) found at a much shallower depth (2.25–2.36 m) is interesting. This consists of the upper part of a leg and a small part of the body. The object must have had incised and dotted decoration, of which only a few dots and a shallow angled incision survive. The fabric is reddish-brown and fragile, while the surfaces are a bright reddish-brown (2.5YR 4/4). The fragment is classified as a leg of a multi-legged vessel, as its features do not match any other type. However, it clearly differs from the common range of rhyta, since it belongs to the Red Burnished category, is squat in section and decorated in a singular way. Most four-legged vessels are Black Burnished, with a much lower percentage of Grey Burnished (also reddish-brown hues) and just a few examples of Matt Painted. No leg sherds securely identified as belonging to other multi-legged vessels, such as tripod cooking pots or four-legged baking pans, have so far been found in B1 or indeed the whole cave. With regard to the identification of rhyton 2d, we note only its curved section, as opposed to the more angular ends of cooking vessels, and the shape of the depression in the upper part, which does not match the deeper open depressions of other vessels. The fragment was found in a layer in which Black Burnished has disappeared, Grey Burnished is nearing its close, and there are very few Matt Painted sherds.

Unfortunately, the data on the structures and pottery of the layer of rhyton 2d are severely deficient. There was plentiful pottery from the destruction of a peculiar ‘circular building’, but this pottery has not been found. Of the few remaining sherds in the group (151 sherds), 81% are coarse ware and 19% fine ware. The latter present elements of mixing. It is possible that the rhyton does not properly belong to the layer, but was moved there from a different area or a different layer of the trench. In any case, the presence of the ‘mysterious’ circular building and the loss of the quantity of known pottery

from this layer will always leave the field open to multiple interpretations.

Two rhyta were subjected to petrographic analysis (Penttedeka 2005, this volume). The analyses showed that the fabric of fragment 2b, classified as belonging to the first group analysed, Fabric Group 1, perfectly matches the local geomorphology. Fragment 2c, on the contrary, belongs to a group which differs from the raw material in the immediate environs of the cave: the closest area of similarity is to the north-east of Diros, in the Gytheion area (CPI 30).

Dating

The origins of the rhyton must be placed very early in Greece, during the Early Neolithic, based on the finds from Achilleion (Gimbutas *et al.* 1989, 208–211, 7.68; Bonga 2014, 22), weakening the argument that the type originated in the West Balkans and spread along the Adriatic coast to Greece (Douzougli 1998, 82; Phelps 2004, 87), and perhaps strengthening the case for indigenous creation and evolution. In any case, rhyta make a systematic appearance in Greece during LN Ia. For the Peloponnese, this dating is confirmed by material from at least five sites (Corinth, Franchthi, Aria, Koufovouno and Alepotrypa) and a worn leg from Raches-Phourno. Corinth and Franchthi have a relatively secure stratigraphy and reference to wares associated with rhyta, which can be compared with the data from B1. Specifically, the rhyta from Corinth Forum West are LN I in date and, as has been aptly noted (Phelps 2004, 86), their extremely high numbers (over 150 sherds) indicate an earlier phase. Rhyta are abundant during the period when Black Burnished and Matt Painted ware predominate, while Grey Burnished is limited. Rhyta continue to be produced, at a lower frequency, in the next phase of the LN at Corinth (Temple Hill), when Black Burnished falls and Grey Burnished and Polychrome wares increase. At Franchthi, six of the 13 rhyta come from a stratified context (FCP 4.1, 4.2) (Vitelli 1999, 50–51), accompanied by a reduction in number of Black Burnished and a leap in Matt Painted, with pottery contexts placed in the LN I chronological horizon. Their production appears to come to an end by LN Ib (Bonga 2013, 223), as no four-legged rhyta were found at Gonia, which dates from this period (Phelps 2004, 86).

The new rhyton data from Alepotrypa Cave, both in the context of the above dating and with regard to other aspects of their excavation and technology, may be summarised as follows: a) the three certain rhyta from B1 (2a–2c) are placed, generally speaking, in the chronological horizon of the Greek parallels mentioned above, and particularly in the early phase of LN I. More specifically, their layers at Diros are placed in LN Ia, on the basis of both the absolute dating and the accompanying pottery finds. According to the radiocarbon dating, they are no later than 4,990–4,780 cal BC (OxA-29275; 5,982 ± 36 BP); b) both types of rhyton leg were found in the cave. All the legs from B1 belong to the high, slender type and are made using the rolled technique, while the Elateia-type legs come from

unknown areas of the cave; c) all three sherds were found relatively close to one another in B1, in a layer with a maximum thickness of 28 cm (3.60–3.88 m). One sherd (2a) is associated with Burial B, while the other two come from a layer above the Burial. Their relationship to the burial assemblage cannot be further evaluated for the time being, due to the lack of precise excavation data; d) for fragment 2d, identification remains open and the question of dating problematic. Although it is derived from layers of slightly later date (c. 4,700 cal BC), the associated finds indicate quite a late phase, raising the question of the chronological and stratigraphic sequence of B1 once again; e) no rhyton sherds are found after the LN Ib period.

Grey Burnished Ware

Grey Burnished ware is represented in B1 by approximately 232 sherds (of which 87 are diagnostic): considerably less than, at roughly a third, the Black Burnished material. The surface colour ranges from grey-black (10YR 4/1) to brownish-grey (10YR 5/2); however, most of the samples are strikingly uniform, with a characteristic greyish-green hue (2.5Y 5/2, 5/3) irrespective of their date. In contrast to the Black Burnished ware, the samples have surfaces that are relatively uniform in colour and, above all, uniform cores in up to 75% of the diagnostic material. This last indicates exposure to partial reduction in the firing conditions, a process requiring highly specialised and controlled handling of the firing to reduce the oxygen feeding the fire, mainly during the final stage, before stopping the firing at the point where reduction begins (Vitelli 1994, 143–148).

The fabric contains small non-plastic inclusions, with a fracture close to 2 to 5 on the Mohs hardness scale, although a certain proportion (15%) is much softer (Mohs 2). A few sherds have a metallic hue, but do not present signs of vitrification in their breaks. Excepting some examples with a conchoidal fracture pattern at a break, the fabric of most specimens (at 20× magnification) looks foliated. The petrographic analysis of two samples and the comparative study of others from elsewhere in the cave (Chamber Z) diagnosed two fabrics (Penedekka, this volume). The first concerns a fine fabric ('Fabric Group 5') that seems to be used exclusively for Grey Burnished and Buff Monochrome vessels, and only in LN. The second, taken from a LN Grey Burnished fruitstand, is a fabric ('Loner Fabric Group 1') that may be defined as imported, its closest and most probable source being the Molaoi area, east of Skala (CPI 30).

Shapes (Figures 4.26–4.29)

Two basic types predominate, present at roughly the same percentages: pedestal bowls ('fruitstands') at 46% and carinated bowls at 39%. The rest of the material consists of carinated bowls (9%) and wide-mouthed vessels (6%), unidentified as to their precise form. Pedestal bowls (Figure 4.26) begin early (3.90 m, in the layer of 'Burial B') and remain in use throughout the Grey

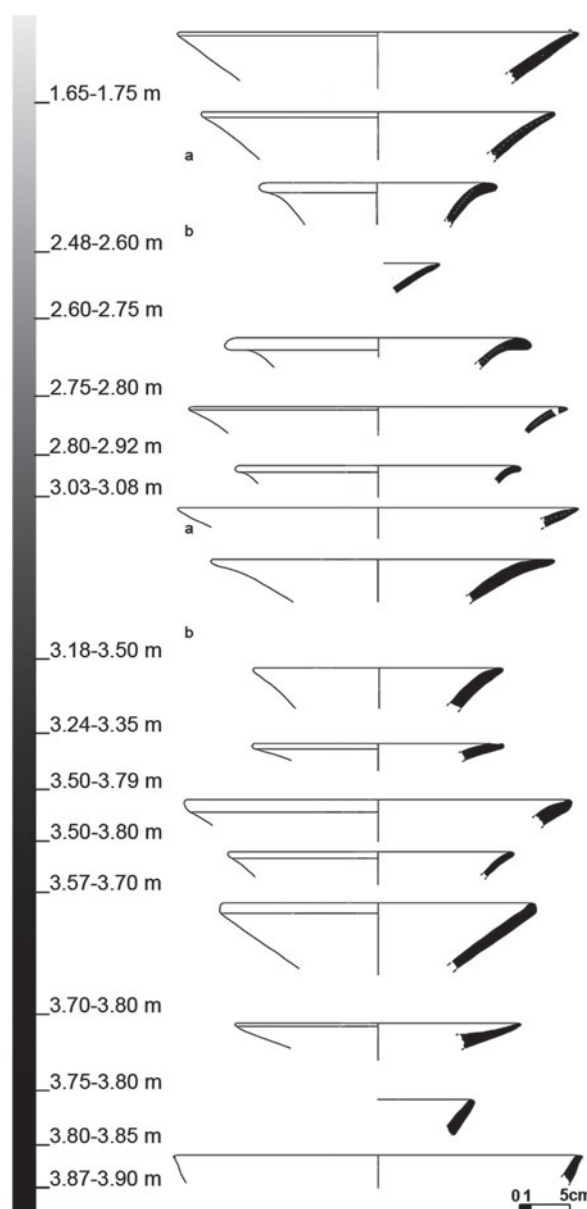


Figure 4.26. Grey Burnished pedestal bowl rims. Form development and find depth (1.65–3.90 m).

Burnished period until its end. Their diameter ranges from 20–42 cm, with widely varying degrees of inclination in the bowl-profiles: this range drastically alters their capacity, producing very shallow pieces with but a small volume (such as sherds at depth 3.50–3.79 m). Generally, the outer walls are relatively straight or slightly concave, but from 2.80 m the later type with a deeply concave outline appears (depth: 2.75–2.80 m). The examples with concave walls and plain rounded or slightly tapered lips in B1 are always late (depth: 2.48–2.60 m, b). A type with a straight wall and tapered lip (depth: 2.80–2.92 m) is found after 3 m: it is not unusual in Grey Burnished, as witnessed at other sites too (Phelps 2004, 77). For those with a bead rim, the section is not heavy; such are generally rare in the Grey Burnished ware of B1, and appear but occasionally and at a later date. The type with

clear bead rim stops at a depth of 3.50 m; it is replaced by a variant with solid one-piece rims or rims with a very distinctive incision (depth: 2.48–2.60 m, *a*). The differentiation seen between swollen rims (with a slighter protrusion for Black Burnished and a heavier one for Grey Burnished), that indicates a later date for the former, is not apparent in the available ceramic material of Grey Burnished in B1. However, pedestal rims with heavier beading are common in the Black-Grey Burnished ware of B1 (not depicted here), a fact that allows them to be placed with Grey Burnished wares, as do other of their aspects (clay, surface treatment, and form).

The bases of the Grey Burnished pedestal bowls are quite different from the Black Burnished ones: they come in a wide variety of forms (Figure 4.27). In some cases, the pedestals are narrow and slightly sloping with relatively straight sides, both in the early (depth: 3.58–3.75 m) and in the late examples (depth: 1.75–1.85 m). The lower part of the bowl, at the point of attachment of the pedestal, bears a distinctive ‘swelling’ (*e.g.*, depth: 3.32–3.46 m, 3.40–3.60 m and other examples not depicted here) similar to that found at other sites, such as Corinth, Argos, and Klenia (Phelps 2004, fig. 30.8, 20, 21). Lastly, although only a few such sherds survive, it seems that in some cases the base differs from that of Black Burnished, as the resting surface becomes more stable: it either thickens noticeably (depth: 3.60–3.75 m) or widens, forming a kind of surrounding band (depth: 3.28–3.40 m, depth: 3.96 m). Mending holes are found both in the bodies and in the solid pedestals, attesting the importance of the original vessel and a desire to preserve it.

The second shape that exists in Grey Burnished ware at a high frequency is the carinated bowl (Figure 4.28). Their numbers rise and fall, but there is always a significant presence from the first appearance of Grey Burnished to its end. The diameter ranges from 14–21 cm. The interesting proposed association of a gentler carination and curved lower wall with an early date, and of a sharper carination and straighter lower wall with a late one cannot be confirmed in the B1 material, but the limited numbers of sherds may be responsible here. Generally, the upper part is either vertical or slightly inverted, with only a single everted example. The characteristic Grey Burnished carinated bowl (Phelps 2004, 31.18; Lavezzi 2003, 69) with its steeply sloping upper body which is often decorated (being both highly protruding and visible), is not always late in date, since it is also found at relatively early depths (depth: 3.58–3.70 m). Black Burnished and Matt Painted wares adopt exactly the same shape in exactly the same period, but in Trench B1 it is the Grey Burnished form that flourishes. The unusual low bowl with sharp carination (platter) appears at a later layer (late LN I), as is the case with the rare parallels (*e.g.*, at Corinth, Phelps 2004, 79).

Shoulder bowls have a limited life span, at least based on the preserved material (Figure 4.29). Unlike the corresponding Black Burnished samples, they do

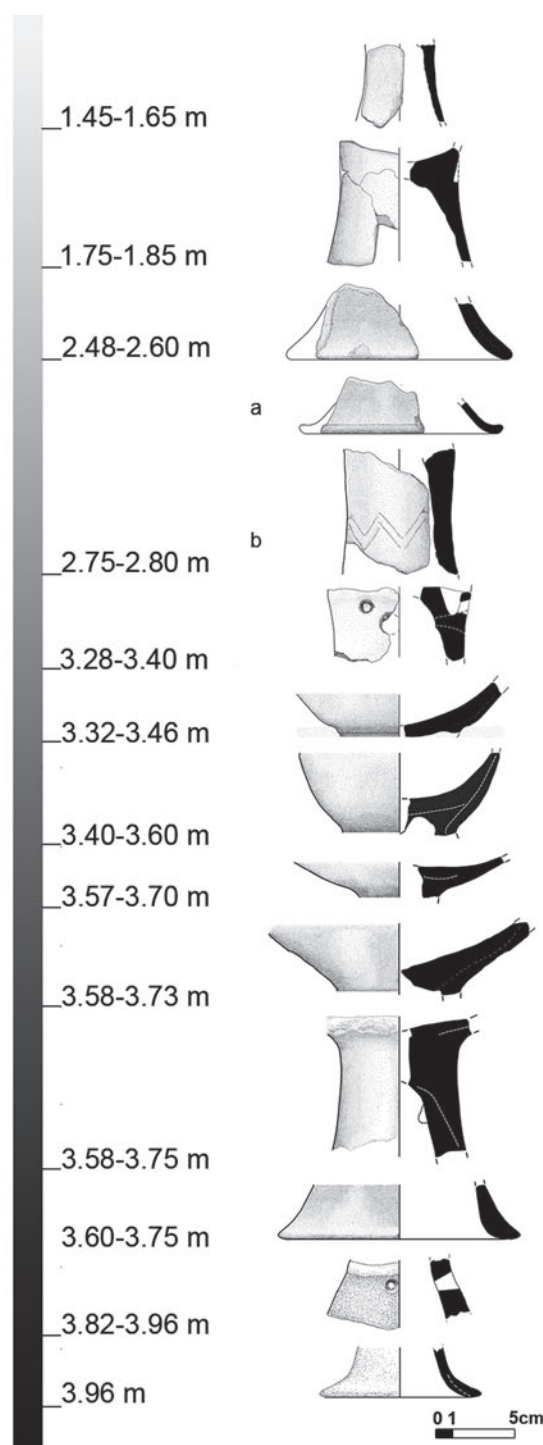


Figure 4.27. Grey Burnished pedestal bowl legs. Form development and find depth (1.45–3.96 m).

not display a great variety of forms. They are relatively gently rounded with gently curving outlines, their walls are generally of even thickness and they lack particularly thickened shoulders (with the exception of the sherd at depth 3.58–3.75 m). Some have exact parallels in Black Burnished ware, their forms paralleling the Black Burnished ones in late specimens. The lip is defined externally with grooving or additional incision under the offset rim. Flat lips

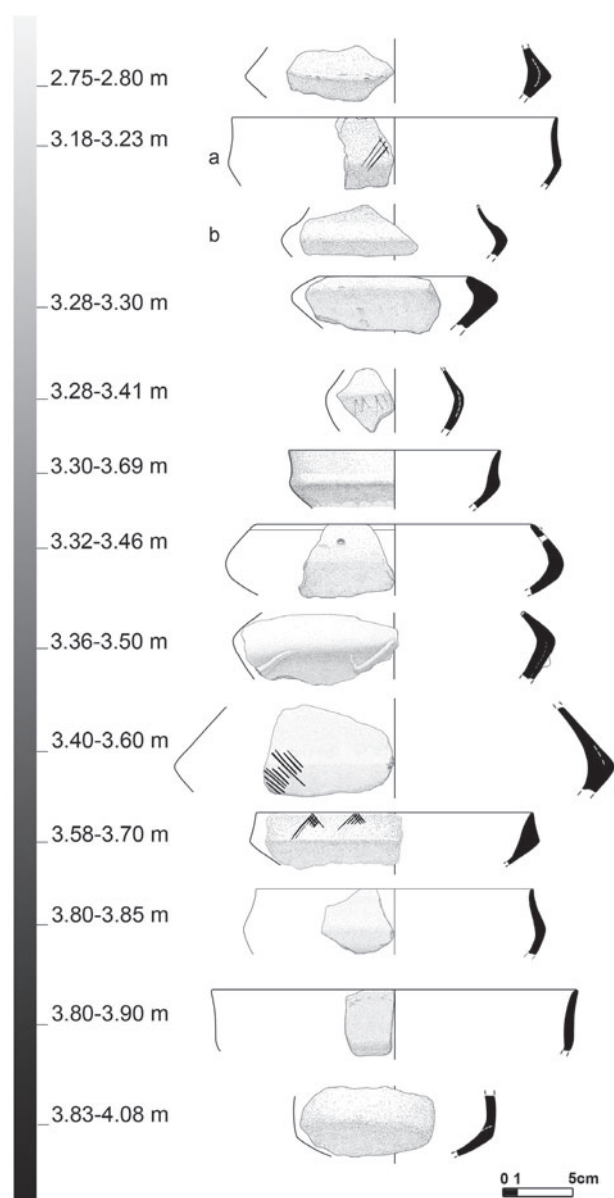


Figure 4.28. Grey Burnished carinated bowls. Form development and find depth (2.75–4.08 m).

(depth: 3.47–3.51 m) are rare. Two sherds belong to S-wall bowls (the ‘concave – convex bowls’ of Phelps 2004, 80).

Their decoration matches the corresponding Black Burnished examples, with appliqué attachments: small pellets, medium or large, oblique and strongly protruding on the curve of the belly. It seems that potters of both wares chose their decorative style according to the vessel type, as they use plastic decoration exclusively on shoulder bowls, whereas they prefer painted and incised decoration on carinated bowls. Finally, only one case of incised decoration on a fruitstand leg is attested.

Decoration (Figures 4.27–4.29)

Grey Burnished decoration, although preserved in only a few examples, is found almost exclusively on bowls. It consists of white and dark brown painted, or incised

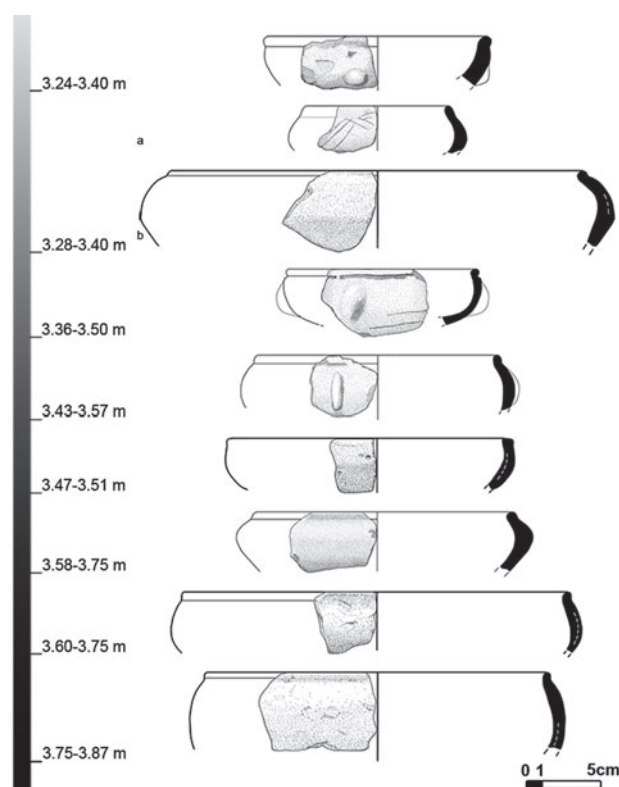


Figure 4.29. Grey Burnished shoulder bowls. Form development and find depth (3.24–3.87 m).

and appliqué decoration. Painted decoration is seen on some sherds from carinated bowls (Figure 4.28). The earliest sherd (depth: 3.58–3.70 m) bears stacked triple chevrons above the break, their bases towards the break and their points towards the rim. This is a very common decorative motif in Black Burnished ware, albeit on different vessel shapes. The fugitive paint (probably off-white) has flaked off completely, leaving only faint traces. Another specimen, (depth: 3.40–3.60 m), probably bore dark grey paint (also extremely fugitive), but the motif has a special character, as it is uniform and continuous, consisting of parallel and oblique lines that must have covered the whole of the body, from the shoulder to below the break.

Incised decoration is found on at least four sherds, three of them from the same layer (3.28–3.50 m). The first comes from an angular shoulder bowl with deep incisions forming the common herringbone motif. The other two (bowl sherd and strap handle) bear roughly scored decoration of simple free chevrons. A sherd of a fruitstand pedestal from an upper layer is incised with a continuous stacked zigzag motif (Figure 4.27, depth: 2.75–2.80 m).

The few Grey Burnished handles of Trench B1 are as follows, in order of appearance by layer but all dated to the LN I period: a horizontal, thin strap handle set directly under the rim of a fine-walled wide-mouthed bowl (depth: 3.81–3.93 m, ‘Burial B’); a vertical strap handle with incision on the back, rising above the rim of

a small open vessel or perhaps a ladle or scoop (depth: 3.51–3.68 m) (for similar example, see Phelps 2004 65, fig. 34.44); and, lastly, a vertical handle of circular section on an open vessel, of which only the ends are preserved (depth: 3.25–3.45 m).

Find depth/Dating

Grey Burnished is one of the commonest Neolithic pottery types from Thessaly to the southern Peloponnese. It is thought to appear slightly after or even almost in parallel to Black Burnished, continuing throughout the LN. To appreciate its coexistence or otherwise with other categories and whether it precedes or follows them, the most reliable source is often Corinth, which is the main area of reference for Grey Burnished; elsewhere, either large quantities are not accompanied by clear stratigraphic evidence (as at Klenia), or sites with good stratigraphic evidence have not produced large quantities (Franchthi). Indeed, as most of the Peloponnesian examples come from Temple Hill in Corinth, it has been argued that, judging from the nature of the clay, it may also have been the production site (Phelps 2004, 85), although this view is now disputed (Sampson 2008, 104; Bonga 2013, 183–185).

The stratigraphic data of B1 provide some new information on the Grey Burnished ware of Diros and its associations with the other ceramic categories: a) Grey Burnished ware appears very early (at the beginning of LN Ia), although this is not definite due to the disturbance of the find area; b) as already stressed above, Grey Burnished does not run totally in parallel with Black Burnished, as previously thought. At Diros, it appears slightly later than Black Burnished and ends after it. It also appears to start almost simultaneously with Matt Painted, always in accordance with the first hesitant specimens of the latter, as it makes an early appearance; c) the occasional coexistence of Grey Burnished ware with late Urfirnis as noted elsewhere, either in significant quantities (as at Franchthi) or in smaller or extremely low ones (as at Argos, Klenia, and Aria), is also the case in B1 (e.g., layer of Burial B); it should be remembered, though, that this is a burial layer with evidence of disturbance; d) Grey Burnished ware never assumes a very active role in the fine ware material, as is the case at many other sites, at least for LN Ib (Bonga 2013, 183). Other categories – Black Burnished and, above all, Matt Painted – predominate, depending on the period involved. Even during the time when Grey Burnished forms appear in their highest proportions, there are no more than 15 sherds in each roughly 20 cm-thick layer, compared to up to 24 Black Burnished and 110 Matt Painted examples; e) the coexistence of Grey Burnished with Polychrome ware, observed at certain sites, is also seen here from early depths, although defining the limits of this correlation remains troublesome due to the difficulty of recognising Polychrome ware sherds; f) finally, the presence of Grey

Burnished in the trench seems to stop at the same time as Black Burnished (around 2.50 m), with only a very few sherds in subsequent layers.

Matt Painted ware

Identifying painted ware in the ceramic material of Trench B1 has proven a particularly difficult task. The vulnerability to wear and the fragility of many fabrics, the specific depositional and post-depositional processes of the cave and the later conservation efforts have all reduced or completely eradicated any traces of paint on most of the material. Moreover, painted ware is the most representative case of classification criteria (Kotsakis 1983), such as fabric type and colour, surface treatment and decoration colour, becoming exceptionally unstable when applied to tiny, damaged sherds. To mention just one example, uneven firing can alter the final paint colour dramatically, even placing it in a different category. This inevitably disrupts the sample percentages, when the lack of decoration due to wear is interpreted as the absence of a certain category. This observation, even if an obvious one, is particularly significant for the material of B1, where a high percentage of sherds preserve no distinguishing features. This final example still leaves room for uncertainty (especially for the Cream Group discussed below).

The Matt Painted ware from B1 is the most abundant fine ware of the cave, numbering 2,766 examples. In view of the difficulties stated above, the sherds with distinct classification characteristics in common were separated out and placed in two basic categories with the following conventional names: 1. The ‘Red Group’ (Matt Painted with black paint on a dark ground) and 2. the ‘Cream Group’ (whitish clay) with three subcategories: 2a) Matt Painted with black paint on a light ground, 2b) Matt Painted with red paint, also on a light ground, and 2c) Matt Painted with black paint on a white-slipped surface. All the other pieces were placed in more open categories, according to the type and prominence of their surviving features. A useful approach in the categorisation of these ‘undiagnostic’ sherds was the ‘ceramic category/fabric/shape’ combination, *i.e.*, whether specific categories were made of specific fabrics in specific shapes. This correlation is seen to hold good for the B1 material (see below, and also Pentedeka, this volume).

1. Red Group (Figures 4.30, 4.31)

The Red Group is the most recognisable one, with no particular visible variations. It is the best example of the ‘ceramic category/fabric/shape’ combination. Two specific vessel types (amphoras and jugs) were made with specific features and decorated for a long period of time with similar motifs and using a similar technique. The surfaces are well polished and lightly burnished with varying degrees of care, externally presenting very strong traces of clay smoothing and cutting. The surface colour

is quite consistent (orange-brown 5YR 5/6, 5YR 6/6), occasionally more orange (Gr 3684) or brown (10YR 6/4). Only in the upper layers, when the red group reaches its end, does the fabric assume a browner hue. In some cases the interior surface is grey (Gr264/D13111), since the geometry of these closed vessels impedes airflow to their interior and reduces the level of reaction on the inside walls, leading to a bicoloured effect (Rathosis 2005, 49). In most examples, the paint is a dull brown-black (10YR 4/2, 10YR 3/2), and, in a very few early cases, reddish-brown (Gr429/D17367). The surface hardness ranges from Mohs 1 to 3, although the clay is very fragile in certain samples. The fabric contains large, non-plastic materials and is evenly fired in many examples. It does not appear to change much over time, as the sherds are quite homogeneous through time and space. Moreover, the pilot petrographic analysis identified red group fabrics from at least 2.60 to 4.00 m (Pentedeka, this volume).

Shapes (Figure 4.30)

The main and almost only vessel type represented in the red group is a vessel with cylindrical neck, one or two strap handles from rim to neck, flat base and spherical or slightly compressed body, with a diameter of 20–40 cm. The typology is familiar from the abundant material from other locations and chambers of the cave (Psimogiannou, this volume). In the examples from B1, these vessels usually have a short or medium neck (4–6.5 cm) with slightly or strongly converging walls, opening outwards again to the rim in many cases (Figure 4.30). The neck-shoulder juncture forms an obtuse angle and is accentuated externally with shallow grooving and supported on the inside with added clay for strengthening, but without particular thickening at this point. The mouth diameter is 8–16 cm. The few examples of handles are mostly straight-sided, with one hourglass shape handle (*cf.* Phelps 2004, 92). They generally have a flat rectangular section with rounded narrow sides and sometimes with a slightly hollow back; no clear D-section backs are known. The bases, difficult to identify among the ceramic material, are usually flat but slightly angled at the juncture with the walls (Gr292/D16905).

Decoration (Figure 4.31)

Based on the fragmentary material, the decoration is repetitive and extremely limited in variety, with a strictly geometric layout. Its clear point of difference with Group 2 is that the lines are relatively thin and the decoration is quite neatly executed (Figure 4.31). The execution is steady and the spaces and pattern accurately measured, as we see from the more complete examples from other parts of the cave (Papathanassopoulos 2011, 193–194). In many examples from B1, the mouth and, more frequently, the base of the neck, are encircled by a medium wide band, very common in Matt Painted ware irrespective of date. The surface of the neck may be

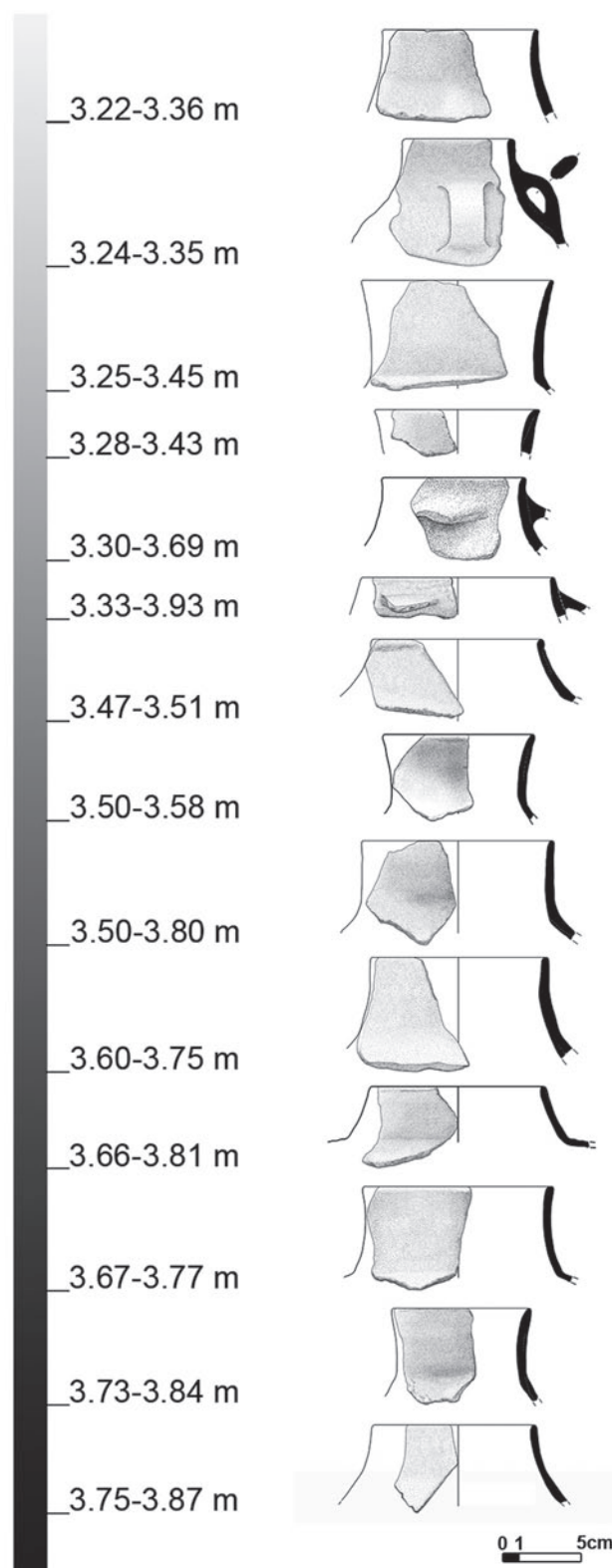


Figure 4.30. Matt Painted ware. 'Red Group' necked jars, upper part. Form development and find depth (3.22–3.87 m).

undecorated; it can also bear wavy or zigzag decoration (depth: 3.33–3.93 m), even simple short lines (separate or in groups). The body decoration is more standardised.

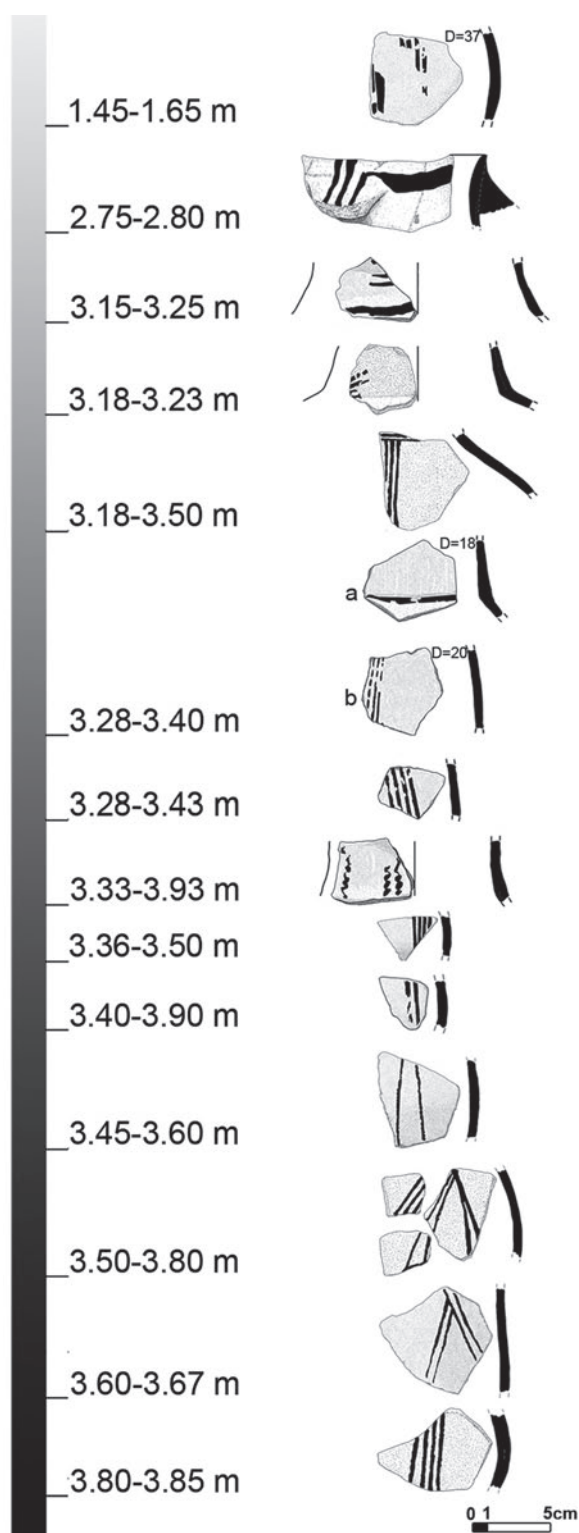


Figure 4.31. Matt Painted ware ('Red Group'). Decorative motifs and find depth (1.45–3.85 m).

Groups of two to four thin vertical lines, widely spaced or forming acute angles, run from the base of the neck and converge towards the base. The backs of the handles are decorated with a group of transverse or parallel lines (Gr82, depth: 2.75–2.80 m).

2. Cream Group 2a

The second category of Matt Painted ware is the Cream Group, which includes all sherds with a light fabric, ranging from off-white (10YR 7/4) to buff (10YR 8/4). The clay is generally soft (Mohs 1 with a few examples of 2), with some small plastic inclusions.

This category is particularly hard to classify, as the sherds are badly worn due to both use and post-depositional processes that have erased any traces of paint from most of them. The same can also lead to confusion between paint and encrustation. This has prevented their classification and quantification and impeded an understanding of shape development; most of the sherds (1,205) are impossible to evaluate. Further, the fabric of the cream group appears (at least macroscopically) to have been used also for Matt Painted with black paint, Matt Painted with red paint, and Polychrome ware. Fragments may thus belong to any of these three categories. Accordingly, they have been classified in the Open Painted categories.

The cream group contains 94 sherds (44 from the storerooms not included in Table 4.1; CPI 28) definitely preserving traces of black paint. These may be tentatively placed in the following subcategories: a) fine whitish clay, evenly fired and exceptionally fragile. These sherds are mainly found in early layers (3.20–3.75 m); b) sherds with hard, solid fabric (Mohs 3), evenly fired or bicoloured, often containing many large non-plastic inclusions. Most of these are late in date; c) sherds with traces of black paint, also preserving a white slip on the exterior. The number of slipped sherds seems to be much higher, comprising both early and late examples. Some late examples even have a characteristic mauveish slip across the whole surface. Lastly, the large open set in the cream group could only be divided into 82 sherds with fragile fabric (sub-category a) and 38 sherds with hard solid fabric (sub-category b).

Shapes (Figure 4.32)

Here, the high fragmentation of the material only permits some general observations. It is interesting to note that the fragile clay fabric is mainly used for food display vessels (shoulder bowls, open bowls, pedestal bowls), to a lesser extent for closed vessels (Red Group and white-slipped), and for only a very few coarse pots and drinking vessels.

Generally, it seems that the Cream Group borrows Black Burnished and Grey Burnished shapes. Some pedestal bowls have a groove at the juncture of body and leg similar to the distinctive feature of Grey Burnished ware. Their bases are generally narrow-necked with flaring feet, regardless of date. A typological exception is an early leg with flaring foot (Gr508), which is closer to the Black Burnished typology. The bowl profiles are easily identified, with a clear preference for flaring

walls, mainly in the late examples, with parallels from Franchthi (Vitelli 1999, fig. 24f, g) or Grey Burnished examples (*e.g.*, Klenia, Phelps 2004, fig. 89, 30.17,19). Finally, none has the rim groove/incision familiar from the other categories.

Shoulder bowls have an exceptionally dynamic presence (31%) (Figure 4.32) compared to carinated bowls (3%); they appear to be the first to form a characteristic and favourite shape in B1. Some of the early examples assume forms similar to Black Burnished ware (Phelps 2004, 90, 39.16), while the later bowls have a strongly projecting shoulder, reminiscent of several Grey Burnished types (Phelps 2004, figs 31, 39.21, 23) and similar examples from Forum West, Corinth (Diamant 1974, 80, 3.81e). Sherds at a depth of 3.40–3.60 m also present similarities to the Forum West Area type (Lavezzi 1978, 423 Figure 8.65). Lastly, it should be noted that no late Klenia and Gonia types (Phelps 2004, fig. 39) were found.

The decoration is impossible to reconstruct from the surviving sherds, but it is clear that the well-organised and elaborate decoration appears in late examples (Gr82 net pattern, Gr53 stacked chevrons). A very few examples have appliqué decoration (depth: 3.36–3.50 m, depth: 3.57–3.70 m).

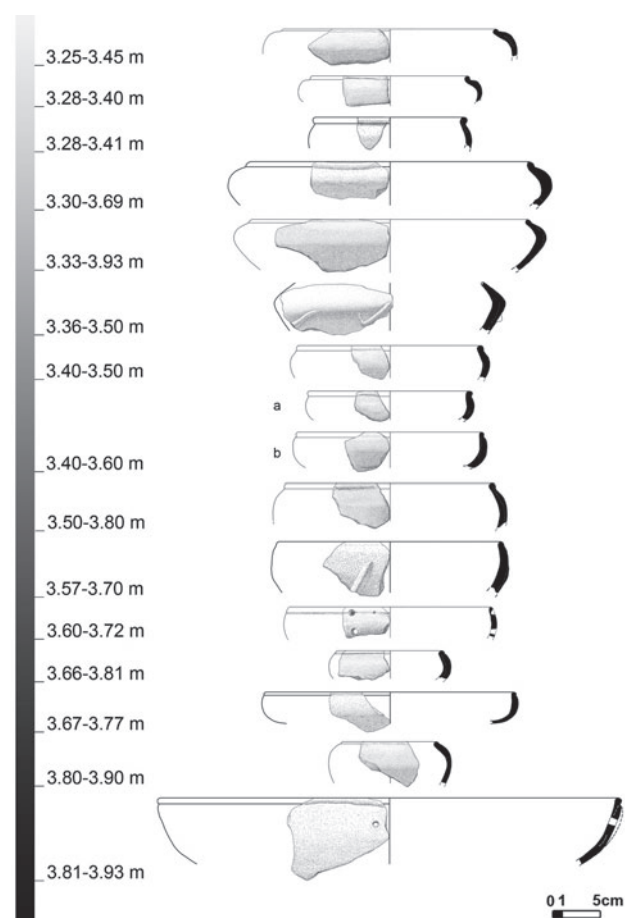


Figure 4.32. Matt Painted 'Cream Group 2a' shoulder bowls. Form development and find depth (3.25–3.93 m).

3. Cream Group 2b (Figures 4.33, 4.34)

The Cream Group with red paint numbers 69 sherds. The surface treatment is identical to that of the black-painted Cream Group, with no visible difference to the naked eye. Almost all the red-painted Cream Group (94%) consists of sherds of whitish and, usually, reddish fabric, with reddish-brown or bright red paint (2.5YR 5/6). This last indicates pigments rich in iron oxides, and fired in a fully or partially oxidising atmosphere (Kyriatzi 2000, 94). In some cases the paint forms simple linear motifs (mainly groups of lines), and in others solid red areas. The latter group is particularly small (6%), appears between 3.20–3.68 m and is easily identified, since these are sherds of closed vessels with calciferous fabrics, brown surfaces (7.5YR 6/3) and deep red paint.

It has been argued that red Matt Painted is later than black Matt Painted, either because it appears to be close to or contemporaneous with later categories such as Polychrome or Red-Stroke Burnished (Phelps 2004, 88), or because in certain cases the sherds have more elaborate decoration (*e.g.*, Salamis Matt Painted ware). However, the lack of stratification at many sites does not yet permit us to draw safe conclusions (Mari 2001, 89).

In B1 this pottery appears very early, about 3.96 m, and with developed decoration, but numbering very few sherds. It first makes an appearance with open thin-walled bowls, 30–40 cm in diameter, with straight walls of relatively even thickness and rounded rims (Figure 4.33). Whether they had pedestal feet or not is unknown. Their plain decoration, strongly associated with this vessel type, consists of groups of lines converging or diverging towards the rim (see similar decoration and also reverse chevrons at Nea Makri, Theocharis 1956, pl. 13, and Franchthi, Diamant 1974, fig. 3.104).

Another type of vessel equally often decorated with red paint in B1 is the shoulder bowl (Figure 4.34), a shape

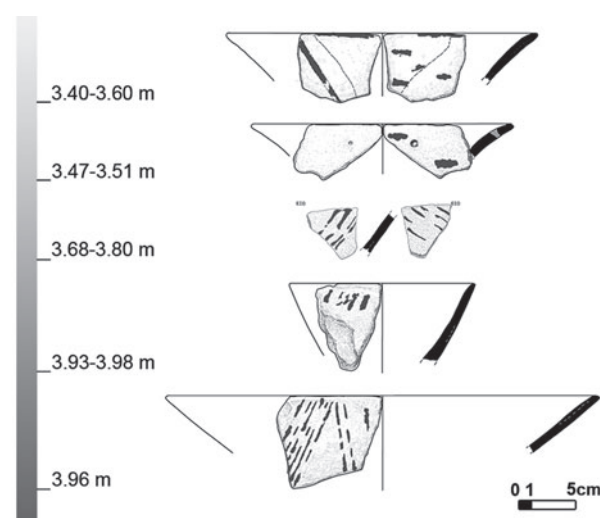


Figure 4.33. Matt Painted 'Cream Group 2b' bowls. Form development, decorative motifs and find depth (3.40–3.96 m).

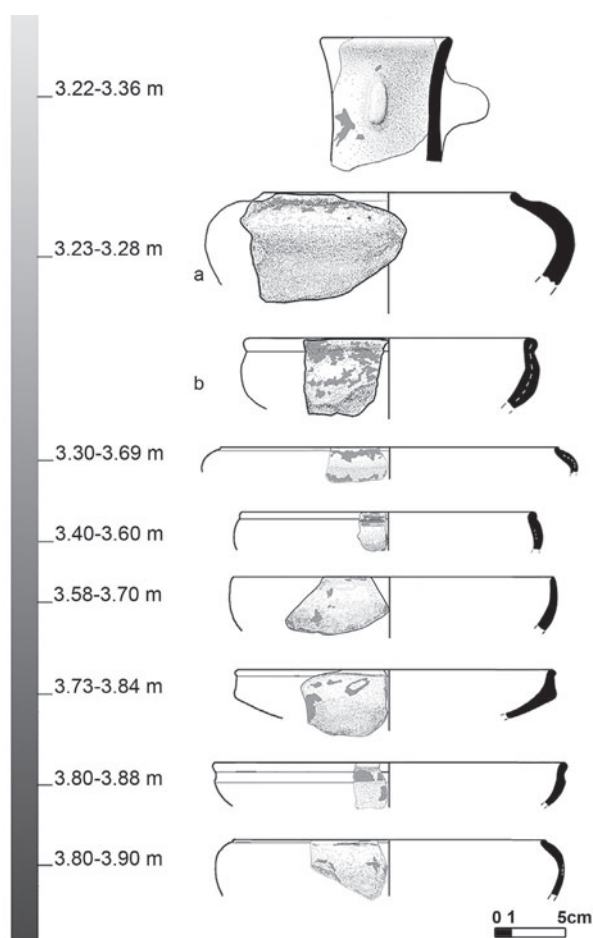


Figure 4.34. Matt Painted 'Cream Group 2b' vessels. Form development, decorative motifs and find depth (3.18–3.90 m).

already known in Black and Grey Burnished wares. The decoration is extremely difficult to reconstruct, its traces being very fragmentary. We do not know if there were any motifs on the body, but in many of the preserved examples the hollow underneath the rim is decorated with a thick red band. Vessels with solid painted areas are few in number, but more typologically varied, consisting of bowls, wide-mouthed jars with horizontal handles under the rim, and also closed vessels. There are two striking examples of sherds from the same find depth, from shapes unusual in B1 (the first from a closed vessel and the other from a mug) with a distinctive lug of square section (Gr268/16692, depth 3.22–3.36 m, Gr247/1652, depth: 3.28–3.40 m, not depicted here).

Matt Painted vessels with red paint are classified more tentatively, since we do not know whether they also had a second colour, which would place them in the Polychrome category. The reverse also applies to Polychrome ware. The difficulty is increased by the fact that neither the fabric nor the typology is of any assistance, as both the Cream Group with red paint and Polychrome ware use the same shapes and fabric. They can only be safely differentiated

if the two colours appear close together, on a Polychrome vessel. This is only the case with a few of the complete examples from Chamber Z, especially where one colour surrounds the other. Usually, however, the red component is found by itself; so it is only on relatively large sherds, with a reasonably complete motif, autonomous decoration or in solid-painted surfaces, that we can be relatively certain that red was the only colour used. In every other case, particularly with very small sherds, identification remains impossible. This means that the quantitative data of Matt Painted ware with red paint from Trench B1 are very unsafe and must be used with great caution when comparing them to other pottery groups.

4. Cream Group 2c (Figure 4.35)

The third category of the Cream Group covers sherds of off-white fabric with a thick white slip on the outer surface. They are placed in the Cream Group on the basis of fabric colour, but are actually very different to the previous two categories (2a, b) as regards the typology of the vessels they are from. Potters mainly seem to use the white-slipped technique for closed vessels (jugs and amphoras).

The white-slipped ware of B1 is represented by 139 sherds, with many good and almost intact examples from the cave. The fabric is mostly orange (7.5YR 6/6 Gr251), sometimes bright in hue (5YR 6/8, Gr85), occasionally brown (10YR 6/4 *e.g.*, Gr247, Gr258) and rarely buff (2.5YR 6/3). The exterior surface and sometimes the inside of the rim or neck bear a thick, uneven layer of off-white (10YR 8/3) or light yellow (10YR 7/4 (Gr85), 10YR 7/6) slip. The decoration is in dark brown (7.5YR 4/3) paint. Based on the analysed samples, the Fabric Group 4 is almost completely restricted to this specific category and period (the LN) (Penttedeka, this volume).

White-slipped vessels very rarely have a second colour (red), which is mainly confirmed by the few intact examples from other parts of the cave; Trench B1 produced only one such sherd. These examples, however, are not associated with the Polychrome ware of the cave, which differs in fabric, typology and technique.

White-slipped ware appears in B1 later than the other two categories of the cream group, ranging between 2.00–3.50 m, although a very few sherds are collected at 1.45–1.55 m, with the greatest peak between 2.40–3.20 m (Figure 4.35). The motifs are arranged geometrically in the area of neck and body, but are executed with relatively hasty and often thick strokes. The common type of decoration has motifs on two sides of the neck, with bands around the rim and the base of the neck, often with vertical lines under the handles. The intervening space is decorated with linear motifs. Repeated geometric patterns appear on the body, mainly emphasising the vertical axis of the vessel. The handles are of the strap, moderately waisted or straight-sided type, with an oval or more rarely D-section,

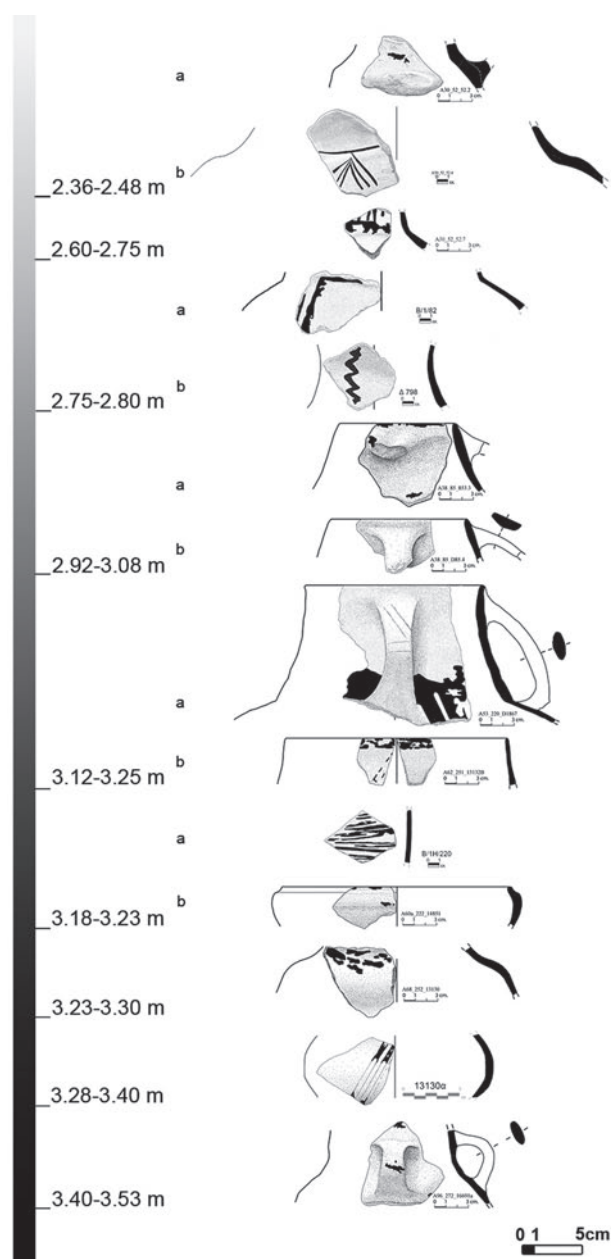


Figure 4.35. Matt Painted 'Cream Group 2c' necked jars. Form development and find depth (2.36–3.60 m).

sometimes decorated with groups of lines and, in one case, with incisions (depth: 3.12–3.25 m, *a*) which were probably used as guides for the application of the paint.

Find depth/Dating

Matt Painted ware is, together with Black Burnished and Grey Burnished, one of the commonest pottery categories of the Late Neolithic, claiming, together with Black Burnished, the title of 'common' Neolithic pottery and playing an active part in a large number of open-air sites and caves from Thessaly to the southern Peloponnese, with both striking parallels and discreet differences.

In Trench B1, Matt Painted is the most abundant fine-ware category of the Late Neolithic. Generally speaking, it appears right after Black Burnished and develops with it and parallel to Grey Burnished. In B1, both Matt Painted groups seems to appear almost simultaneously, with the exception of the Cream Group 2c sherds, which appear slightly later. We will limit the chronological overview to the Red Group, since it is represented by more sherds over a longer period of time and its development is easier to follow.

The first definite Red Group sherds come from the layer covering Burial B, at a depth of approximately 3.80 m. However, sherds arguably of the same group are also found in earlier layers, although their identification and dating are far more tentative. These earliest Red Group sherds appear at a depth of 4.20 m (c. 5,400 cal BC); they are but a few tiny examples of bright orange, soft fabric with many inclusions of varying sizes, few traces of paint and worn surfaces. Generally, the fact that the early examples are small and worn makes their identification difficult, as they are very similar to the fabric of older categories. Thus, at this stage of research and before further excavation and study, the material does not help us to argue confidently for a possible connection with earlier categories such as Urfirnis, or to confirm that we have here early experimentation with Matt Painted, as at Franchthi (Diamant 1974, 43–45), or a 'Hybrid Ware' (Phelps 2004, 96) bridging the gap between Middle Neolithic Urfirnis painted and Matt Painted, although this cannot be excluded. Moreover, the impressively large Red Group sherds also found at a very early depth (4.07 m), with good forms and structured decoration, are probably pit material (see above and Papathanasiou, Chapter 2 this volume). The Matt Painted sherds immediately following these pieces are those in the layer of Burial B (depth 3.80–4.00 m, also dating to c. 5,400 cal BC): their ware assignment is more certain. But their presence in a burial area raises reservations once again as to the terminus post quem of Matt Painted ware: the findspot is partly located in a burial pit and the material is therefore mixed. The lack of detailed excavation data (physical limits of pits, etc.) makes it impossible to be certain whether the discovery of late sherds in earlier layers applies to the whole of the pottery from Group 2, including the Group 1 sherds. If some of the material from Burial B is undisturbed, this could make it very early.

If we decide that the layer over the burial is the first definite appearance of Matt Painted (ignoring the earlier concentrations), then we have a starting point: when this pottery appears in Trench B1, it is both developed and abundant. At a depth of around 3.60–3.80 m, Matt Painted forms 64% of the total, compared with 24% for Black Burnished, 8% for Grey Burnished and 4% for common fine ware. So it has clearly originated at an earlier date than it appears in the trench, making its inception rather earlier than the layer covering Burial B.

After 3.60 m, the concentrations of Matt Painted do not change in essence, but may vary according to the area excavated, with distinct and sudden concentrations such as that near the 'Hearth II'. What does change most is its proportion apropos the other fine ware groups: its rise as theirs decline. At its greatest peak, around 3.20 m (c. 4,800 cal BC), the percentage of Matt Painted reaches 75% of total fine ware (counting all sherds of both groups with traces of paint and 'undiagnostic' sherds), while Black Burnished has dropped to 9% and Grey Burnished to 5%. White-slipped Matt Painted sherds are the least prevalent, although they, too, appear to increase around 3 m.

After 2.80 m, the concentrations of Matt Painted ware decrease significantly. The last 50 cm (2.40–2.90 m) produced just 183 sherds compared to six times the number (1,177) in the preceding 50 cm. Very few sherds were collected after that.

Based on the absolute dates of the trench, Matt Painted ware appears to predominate in B1 mainly during LN Ia and ceases to be 'produced' at the start of LN Ib.

To summarise the above: although we cannot pinpoint the first appearance of Matt Painted due to the disturbance of its findspots, its presence in B1 must be considered early. The material is too fragmentary to draw secure conclusions with regard to dating, but it would seem that placing Matt Painted ware later in the chronological sequence (Douzougli 1998, 94) would not explain all of the material everywhere. This later dating applies more to the white-slipped examples with careless wide bands, which does anyway hold good in the trench, or for the later examples of other categories (see above for the shoulder bowls of the Cream Group). The Grey Burnished imitations of later types are not found in all the material, but only in that after 3.50 m. The metopic style has not been diagnosed in the sherds from B1, perhaps partly due to the fragmentation of the material; on the contrary, the surviving fragments usually bear wide straight bands and isolated motifs. We may, of course, be faced with a different, local expression of late features. If we accept that Matt Painted appears at 3.80 m, it seems to enjoy an exceptionally high presence in Trench B1 compared to the other fine ware categories. Matt Painted definitely coexists with Black Burnished, Grey Burnished and a few sherds of Urfirnis. The Matt Painted ware of B1 has the features of a type of pottery produced more hurriedly, with hasty, uneven strokes, poor paint attachment and less smooth or burnished surfaces compared to more carefully made wares at other sites. This is generally true for a large proportion of the material, particularly the white-slipped vessels, although careful decoration can also be seen, in the red group for instance. The vessel outlines are equally precise. The main characteristics of Matt Painted ware in B1 seem to display a repetitious and weakening combination of originally dynamic motifs. In B1, Matt Painted ware with red paint appears early and just after Matt Painted with black paint, although in far lower

percentages, with almost no chronological separation of the two. Thus the possibility of a later date for the Red Group cannot be upheld, at least in the case of B1. Finally, the persistence of shapes (amphoras, shoulder bowls), the homogeneity of fabrics for long periods of time (Red Group), and repeated decorative styles (such as the hasty motifs of the white-slipped or the linear patterns of the Red Group), combined with the quantity of material discovered, all provide escalating support to the supposition of a 'local' production, one featuring homogeneity and internal consistency.

Polychrome ware

Polychrome ware is represented in Trench B1 by very few examples, since many of the sherds that could belong to this type must remain unidentified, as explained above. The surfaces are highly polished and burnished with a thin slip. The fabric in all cases is basically off-white (10YR 7/4, 8/4), fragile (Mohs 1–2), evenly fired, with tiny non-plastic materials and characteristic soft, brick-coloured inclusions in some samples. The decoration is with dull brownish-black (10YR 4/2) and reddish (2.5YR 5/6 or 5YR 5/6) paint. The later samples (depth: 2.36–2.60 m) are particularly problematic and more ambiguous. They come from fine-walled closed vessels, of dark brown fabric (7.5YR 7/6) with a grey interior (5YR 6/2). They contain relatively large inclusions, and the paint, of which only a few traces remain, is darker. In one case the exterior surface has a thick layer of light brown slip.

Shapes (Figure 4.36)

The shape repertoire of Polychrome painted vessels includes open bowls with straight sides of even width (Figure 4.36). Whether they had a foot or a flat bottom is unknown (*cf.* Gonia, Blegen 1930, 70). There are also closed vessels with a high straight or medium-sized neck, common in Matt Painted ware. A special case is a shoulder bowl, a very common type in B1 in all the previous ware-categories, but infrequent at Peloponnesian sites in Polychrome ware (*cf.* parallel from Nea Makri, Theocharis 1956, 22, pl. 14.3).

Decoration (Figure 4.36)

The decorative repertoire is impossible to reconstruct from the scanty, poorly preserved sherds. From what survives, it seems that at least two decorative styles are used; these have been proposed as being chronologically distinct (Weinberg 1962, 198). There is the early style, with simple patterns in which the two colours are separate and cover equal areas, and the late style, where the two colours are combined and black is mainly used to outline the red motifs. The stylistic differences in the Peloponnese are more complex; they are represented by three main sites, Corinth, Gonia and Klenia. In brief, according to the classification proposed by Phelps (Phelps 2004, 99), the patterns are simple linear motifs, mainly black (Corinth),

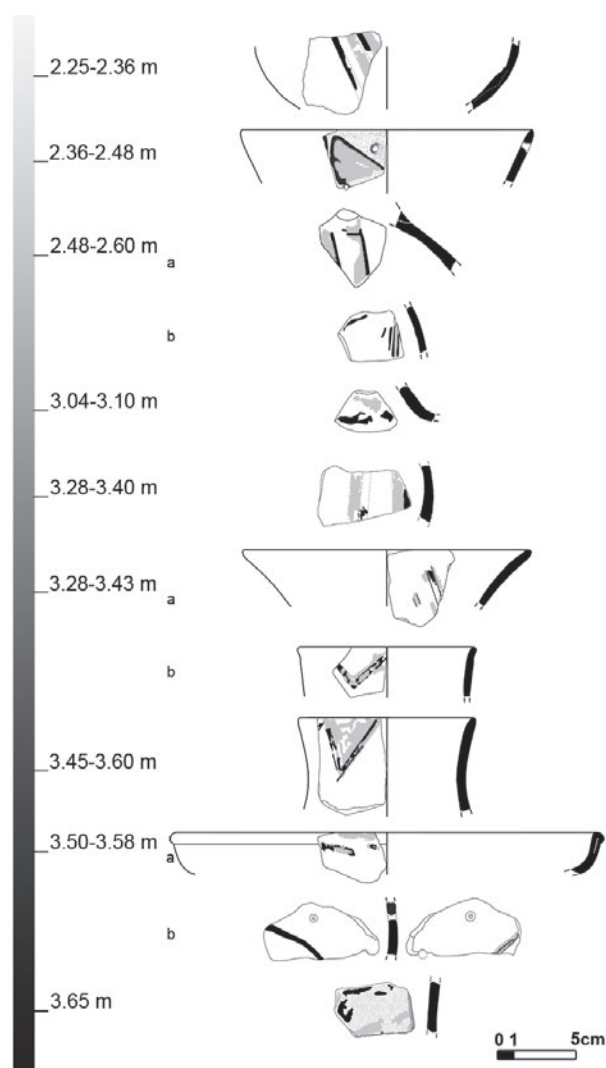


Figure 4.36. Polychrome Ware (Group I–II). Vessel types and find depth (2.25–3.65 m).

red ornaments outlined in black (Gonia), and motifs in which red is the primary colour and black is secondary but not used for outlines (Klenia). This classification groups together many Polychrome ware finds, but it is disputed due to incomplete stratigraphic data (Bonga 2013, 110). The surviving samples from B1 are too few and fragmentary for the original decorative motifs to be precisely defined, and thus help divide the two styles into early and late, a distinction which is, in any case, already widely disputed (Phelps 2004, 96; Douzougli 1998, 110–111). Even a secure classification in the styles detected at the above sites is difficult. Nevertheless, the study of even this handful of sherds has provided some useful information.

First, it is noted that in the identifiable sherds (we do not know if there are earlier, undetected examples) the two basic styles (and perhaps also a third which is harder still to classify) appear together, in the same layer (3.45–3.60 m) and progress thence in parallel.

The sherds of the first type preserve thick parallel bands, vertical or slanted, alternately red and black (e.g., depth: 3.28–3.40 m). The lines are simply placed and occupy an equivalent area, in a pattern reminiscent of the few sherds of polychrome decoration from Corinth Forum West (Lavezzi 1978, 446–448, pl. 110.57 and 58), but due to the fragmentation of the decoration it cannot be definitely confirmed that one colour predominates in the rest of the motif; both colours appear to be autonomous. On the second type, the motifs are red outlined in black: triangles surround the necks of collar jars, either hanging from the rim or with the apex pointing towards it, a very common motif in the Matt Painted ware in the cave and a popular pattern among local potters. The second type resembles that at Gonia, where black surrounds the red designs. The black outline is added after the painting of the red motif, as shown by the red brush-strokes extending beyond the limits of the black outline, as is usual in the Gonia style (Phelps 2004, 99). The decorative triangles differ from those of other sites, for instance Gonia, where they are much smaller (Blegen 1930, pl. Ic; Phelps 2004, 46.9, 10) or placed on a different part of the pot (shoulder). Finally, a third, putative category consists of sherds on which both colours are used independently but spread across large areas of the surface. Unfortunately, these sherds are extremely worn and preserve very few traces of decoration, hindering their clear identification.

Dating

Polychrome ware is considered to be ware that develops in LN Ia and LN Ib, forming an early and a late style respectively, although it has been argued that it appears later and does not mark the start of LN Ia (Mavridis 2008, 120). The dating of the Polychrome pottery in the Peloponnese is chiefly based on the material from Corinth, the Klenia Cave, Gonia, and Prosymna, and to a lesser extent on the less numerous samples from the Argolid basin (Franchthi, Lerna, Aria, and Aspis Hill at Argos), Laconia, and Arcadia (Kouveleiki Cave A, Kandhila-Bikiza, Apidia). Its starting date is closely linked to the presence or absence of early pottery categories such as Black and Grey Burnished and Matt Painted wares, and to the find percentages of these categories where they coexist.

The B1 material is far too limited in size and number to make a serious contribution to the dating. All that can be evaluated here is the findspot of the Polychrome examples in B1, the dating of the find layers, and the pottery categories that follow them. The first Polychrome sherds in B1 appear in an early context, at a depth of 3.65 m, around the end of LN Ia (before c. 4,800 cal BC), although we must be aware of the dangers of intrusion, as the quantity of the material is small and the area disturbed (see Papathanasiou, Chapter 2 this volume). Even if these sherds are intrusive, however, the samples immediately above, from a depth of 3.28–3.43 m, also come from

a late LN Ia layer (with a date of 4,990–4,780 cal BC (OxA-29275; $5,982 \pm 36$ BP)). With regard to the pottery associations, these first sherds were found in a layer where Matt Painted completely predominates (66%), over Black Burnished (26%) and Grey Burnished (8%).

The following examples (3.28–3.43 m) come from an excavation spit showing a dramatic increase in the proportion of Matt Painted (78%), compared to Black Burnished (13%) and Grey Burnished (9%). No Polychrome sherds are subsequently identified except for a single sherd between 2.46–2.36 m (and perhaps two more), in a context that is particularly problematic because, although the charcoal samples give an LN Ia date, the pottery data indicate a later period, when Matt Painted is coming to an end and vessels with plastic and rope decoration, as well as cheese pots, have already made their appearance. The last two sherds are mentioned almost in passing; further study is necessary because, besides having two colours, the sherds are very different in fabric, surface treatment and paint to the known Polychrome sherds of B1, while the wider disturbance of the find area renders their secure assignation here extremely doubtful.

Although the very small number of samples does not permit them to be securely dated, taking all the above data together, just the following points may be made. Polychrome ware appears in B1 in late LN Ia, in contexts dominated by Matt Painted, whose course it follows until its end. The absolute dating of the layers in which Polychrome ware was found gives a very early date of c. 4,800–4,750 cal BC and perhaps even earlier. The ceramic associations are more reasonable and match those at other sites. The difficulty of identifying Polychrome ware prevents us from establishing if it makes an earlier appearance, to the beginning of LN Ia; according to the current data from B1, the first sherds are collected after the appearance of Matt Painted ware. The presence of Polychrome ware in B1 is particularly small and it certainly does not play a dynamic part, as at Gonía, Klenia, or Prosymna, even if we include a few unidentified sherds of whitish clay which may belong to this category. No sherds with black-and-white decoration ('Aria style', Douzougli 1998, 114) were found. The shapes, clay fabric, and decorative motifs perfectly match the local dark pottery of Diros, so there is no reason to suppose that these are imported vessels. Finally, the simultaneous presence of both decorative styles in the same early layers, even though the samples are few, indicates that the hypothesis that two styles belong to different chronological horizons should be re-examined, at least with regard to the case of B1.

Rippled/fluted decoration (Figure 4.37)

Fourteen sherds, mainly from monochrome, burnished collared bowls, bear rippled or fluted decoration on the body (Figure 4.37). These are sherds from vessels with

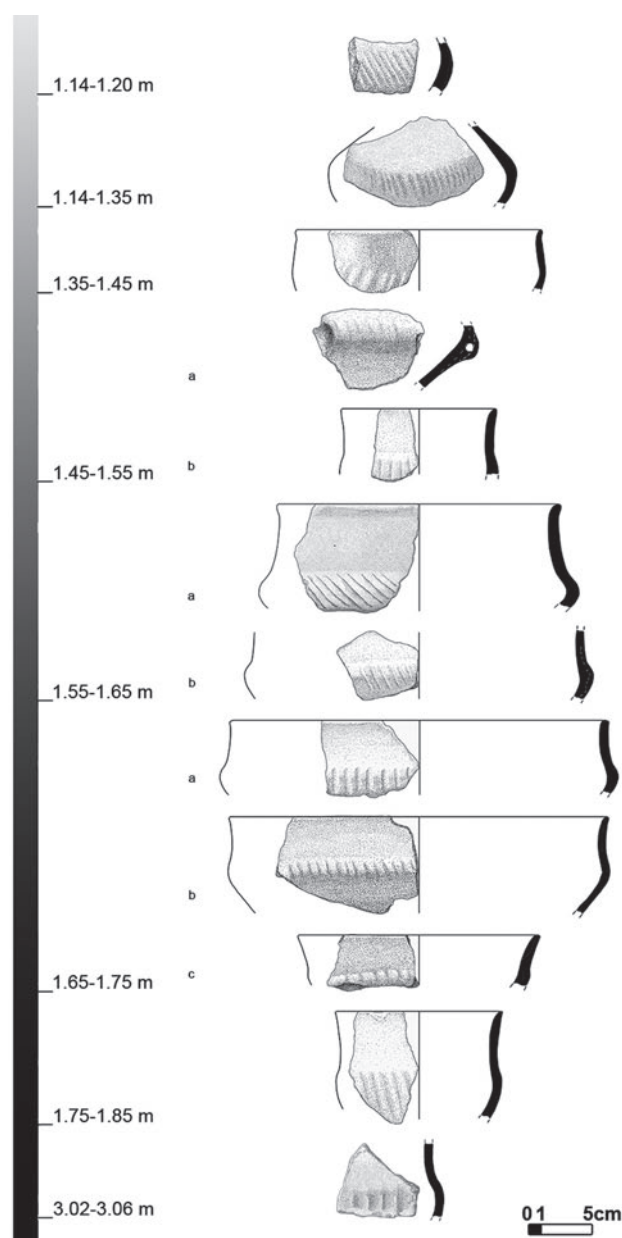


Figure 4.37. Rippled ware. Form development and find depth (1.14–3.06 m).

a deep, curved body and straight, particularly high neck (3–6 cm), often slightly concave in profile. The neck portion is shaped separately and attached to the body. Internally at the neck-body junction an additional layer of clay supports the neck, forming a prominent protrusion on the outside. The rim is rounded and slightly thinner at the top, while in one case (Gr39/D664, depth: 1.65–1.75 m, a) the top is flat. The rim diameter ranges from 10–30 cm.

The core is uniform or vaguely two-tone in colour and contains many relatively small non-plastic inclusions. The surfaces are usually blackish-brown (7.5YR 2.5/1) or brown (5YR 5/4–4/4) and only reddish (2.5YR 4/4) in a single sample; they are always very highly burnished. Some samples present undefined firing spots.

The ripples start at the attachment point of the shoulder and usually cover the whole curve of the belly. They vary widely as to their direction (vertical or angled), number (sparse or dense) and relief (high or low relief ridges). At times the ripples are so shallow that they are only perceptible to the touch or under the right lighting (*e.g.*, depth: 1.45–1.55 m). Surface wear may play a role here too. In the case of angled ripples, they are usually slanted diagonally from upper left (also seen in examples from other sites) and only in two cases diagonally from upper right. The shape and strictly regular spacing of the ripples indicates precise measurements in the execution of the decoration and the use of a special tool, probably a round-tipped implement.

What is interesting about the ware with ‘grooves’ from B1 is the insistence on the offset-collar bowl type with two exceptions: sherd Gr34/D4678 (depth: 1.45–1.55 m), from a strongly carinated bowl with a tubular handle at the curve of the belly (see also Vitelli 2007, fig. 82. a, d), and a sherd from a closed vessel (S5/2011, depth: 1.15–1.35 m). The rippled-ware version of the collared jar is placed in the early phase shapes of Period IV (Phelps 2004, 113). It is a common type in Burnished wares both at Alepotrypa and at other sites. In B1 the type is found in late Grey Burnished, with walls of similar thickness but a lower collar, and in Monochrome Burnished. Indeed, a variant of the collared jar with a distinct step at the neck (Phelps 2004, 113, 53.8) appears in B1 in examples of late Monochrome Burnished, alongside Rippled ware (LN II). It should be noted that necked jars/bowls with early decoration with ‘grooves’ are often grouped together with vessels with a strong presence at the transitional period from FN to EH, both in SE Europe and in Greece (Johnson 1999, 325–328). It is interesting to note that this decoration, even in late specimens (*e.g.*, early stage of EH I at Eutresis, Caskey and Caskey 1960, 140, fig. 4, III.10, pl. 47.III.10) and using a different ridge technique (see below), continues to be faithfully associated with the collared jar type at many sites (Sherratt 1986, 435, pl. xciv).

Find depth/Dating

Overall, sherds with ripples are dated from the LN Ib period, as at Kastria (Sampson 1997, 127–128, 256–257), to LN II, as at the Agora (Immerwhar 1971, 9–10, pl. 6.70–75), Tharrounia (Sampson 1993, 185, figs 4–6), Sarakinos Cave (Sampson 2008, 275–276, fig. 150) and Lerna (Vitelli 2007, 125–126, fig. 82 a, c, d). This wide chronological range seems to embrace multiple grooving techniques, probably marking corresponding differences in date. Generally speaking, the techniques used to produce vessels with grooves are rippling, channeling and grooving. However, due to the extensive use of the terms and the differences in meaning compared to the single Greek term that covers all of them (‘*avlakoti*’ decoration), these three terms are often used in the bibliography without clear distinction or precise definition

of the technique used. References to parallels even group together sherds from other categories, due to the fact that the matching of technique and terminology is not completely accepted by all scholars; *e.g.*, Phelps uses the term ‘fluting’ (Phelps 2004, 82) for the category that Bonga uses as an alternative to the term ‘grooving’ (Bonga 2013, 147). In any case, it seems that the decoration known by the generally accepted term ‘rippled’, with fine shallow parallel grooves (commonly on Black Burnished ware), is the earliest to appear (LN Ia). It is followed by decoration with wider grooves set further apart, known as ‘channeling’ (or ‘fluting’), and then by ‘grooved’ decoration, ranging from deeper grooves (Bonga 2013, 147–148) to incisions (Sampson 2008, 64), although this tripartite distinction of terms and dates is not always followed by scholars (Phelps 2004, 81–82).

Unfortunately, the material from B1 does not contribute much to the clarification of terms, techniques and dates. For a start, the sherds from B1 do not belong to Black and Grey Burnished ware but to Monochrome Burnished vessels. The material appears to be mixed, at least regarding the first two categories (rippling and fluting). Most sherds bear shallow to almost indiscernible grooves and ridges with rounded backs which could be classified as ripples. The sherds at a depth of 1.55–1.65 m, *a*, and 1.65–1.75 m, *a*, are closer to fluted decoration. However, the earliest example with grooves was collected deep down (depth: 3.02 m) and dated to the end of LN Ia (4,990–4,780 cal BC (OxA-29275; 5,982 ± 36 BP)), although it may be intrusive, since the layer in question is badly disturbed. This sherd, albeit the earliest, bears the sharpest ridges and widest grooves of all, is clearly distinct from rippled ware and looks more like sherds described as samples of grooved decoration (Sampson 2008, pl. 24 top row). Another very early example of unclear technique, dated to LN Ia, is reported from Tharrounia (Sampson 1993, 62, fig. 56.5).

Overall, the B1 material bearing decoration with grooves displays a mixture of techniques (rounded and sharp edges, narrower and wider distances between strokes) independent of depth. We do not know if this can only be interpreted as the result of disturbance. The sherd immediately following the first sample is placed in the same period (end of LN Ia) regarding absolute dating, but in a different pottery context. All the rest have been located between 1.20–2.36 m, with the greatest concentration at 1.55–1.75 m. According to absolute dating, these seem to prevail mainly in LN Ib and just about continue into LN II. Towards their end they overlap with the first rolled rim sherds (1.20 m); later, in late LN II, no more specimens are found.

Coarse Ware

Storage Vessels

The inappropriate term ‘coarse ware’ is used conventionally in this chapter for strictly practical reasons, being most

widely used in the bibliography to date, although the ‘correction’ of its terminology has already begun (*e.g.*, Bonga 2013, 265–266). In fact, it simply covers vessels of coarse construction, fabric and working, and the typological particularity of these vessels (used primarily for storage and food preparation).

This is the most numerous ceramic category from Trench B1: of the total of 26,847 sherds covered by this study, 86% are coarse/semi-coarse sherds. Of these, only 4% are decorated and only 7% are ‘diagnostic’ (rims, bases, handles, lugs), making the vessel type at least partially identifiable. The rest of the material remains unidentified (‘non-diagnostic’ sherds) and of low analytical potential, as their size, state of preservation and the fact that they body sherds render them typologically anonymous.

The coarse ware in B1 is limited in the lower layers, except for the depth of around 4.30–4.50 m, where, however, the majority of sherds are of especially small dimensions, but rapidly increases significantly into the upper layers, although not always steadily. The beginning of the shift is noticeable at 3.60 m where a remarkably great concentration of sherds is evident, but the greatest expansion starts towards the end of LN Ib. Overall the ware becomes around 6 times more frequent between its lowest and uppermost appearance compared to fine ware, replacing it almost entirely in LN IIB. This ratio broadly matches the observation made by all Neolithic coarse ware research as to its rapid increase over time, at the expense of fine ware.

From a depth of 2.80 m and up, one vessel type takes centre stage in the coarse ware repertoire: the storage vessels (pithoi and pithoid jars). Pithoid vessels were particularly concentrated in Chamber B of the cave, including Trench B1 (see also Valvis, this volume). It should be noted that pithoid vessels are considered especially significant due to their larger size; they require more raw material, increased production time and greater care in firing (Vitelli 1993, 99). They are also particularly useful in the interpretation of the ceramic material, being associated with production of surplus goods or, at least, with a completely different way of handling a naturally occurring glut of goods (Touloumis 1994, 141).

The number and type of pithoid jars in B1 is impossible to calculate, even roughly, because they are macroscopically very similar, the samples are badly worn, joining sherds are rare, and the vessels from which they come are large, meaning that many sherds may belong to the same pot. Such fragmentation aside, the identification of pithoid jars in B1 also raises the question of storage jar nomenclature. This type of pottery often lacks clear definition criteria in the bibliography, because some of its characteristics are strikingly similar to those of coarse ware of almost any time and place. One safe criterion by which storage vessels may be defined, at least in the LN, is the close connection between ‘technology’ and shape:

thus, a storage jar can be identified as such only when the size and shape of the vessel and its constituent parts (diameter of rim and base, wall thickness) are examined together with the production technology and method (Touloumis 1994, 100, 102).

Another basic feature assisting in sherd identification, particularly in the case of fragmentary material such as that of B1, is the decoration of LN pithoi. Thus, many small, worn sherds were yet identified by the characteristic plastic and rope motif (relief band) decoration.

The number of pithoi represented by the 679 sherds (505 with rope decoration and 174 with plain plastic decoration) is unknown. The pithoi are considered utilitarian vessels with a low rate of replacement, as they have the lowest breakage rate amongst pots (1.87 compared to 3.36 for cooking pots and 13.06 for food display vessels: Mills 1989, 139).

Shapes

The type and size of the pithoi from B1 are unknown, as no examples preserve a full profile (see Valvis, this volume). However, a good idea of these pithoi can be derived from the examples from similar depths found in the area closest to B1, the ‘North Sector’. The pithoi from the cave have open or wide mouths, conical bodies and usually narrow bases (Papathanassopoulos 2011, 163, Diros Neolithic Museum D12382). The rims of the pithoi from B1 (57 sherds) come from large, open or slightly inverted mouths, with a diameter of 25–64 cm (Figures 4.38 and 39).

Storage jars with this type of mouth are termed vessels with a high level of accessibility (Christakis 2005, 48), given that they provide good visibility and control of the contents, and the interior is easy to clean. They are intended for storage of solids, their structure making them easy to fill with grain and then withdraw it (Henrickson and McDonald 1983, 633; Touloumis 1994, 101). Their main drawbacks are the difficulty in ensuring the safe preservation of the contents and that of transporting the jars (Christakis 2005, 46). However, external rolled rims, as mainly found in the upper layers of B1 (*e.g.*, depth: 0.20–0.35 m), are thought to facilitate the placing of a cover, as the row of holes under the rim further confirms (depth: 0.20–0.35 m, *a, b*). Yet we must not forget that ethnographic parallels show that the function of a pithos has more to do with its overall profile and less with the shape of the rim, which may be a matter of style or chance (Henrickson and McDonald 1983, 635), an element that cannot be evaluated for the fragmentary material of B1.

The walls are 9–18 mm thick and have a diameter range of 30–64 cm. Few bases have been preserved (22 sherds; Figure 4.40): they are flat, 1.0–1.5 cm thick and quite narrow, with a diameter ranging between 17 and 32 cm, with most not exceeding 20 cm. According to the ‘three levels formula’, vessels with a base diameter under 20 cm have a maximum body diameter of 37–87 cm, with

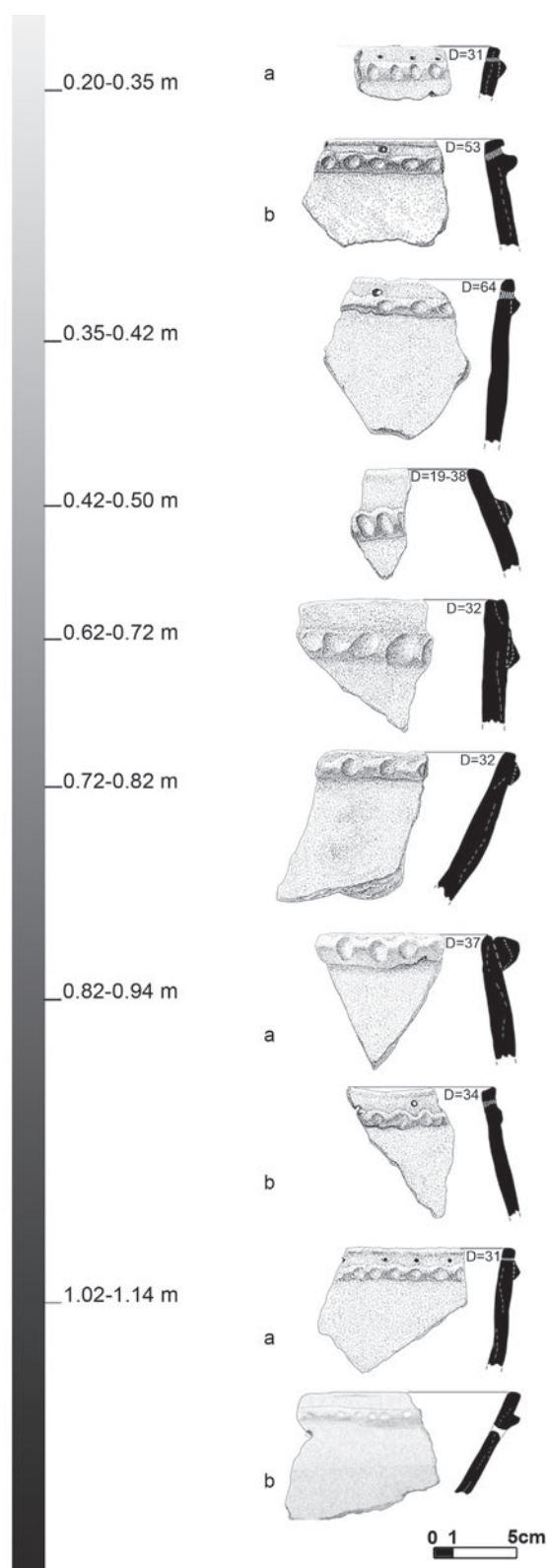


Figure 4.38. Pithoid rims with rope decoration. Form development and find (depth 0.20–1.14 m).

a capacity under 30 litres (Van Effenterre 1983, 61). They represent pithoi of a low stability, indicating that the vessel was movable (Christakis 2005, 46–47).

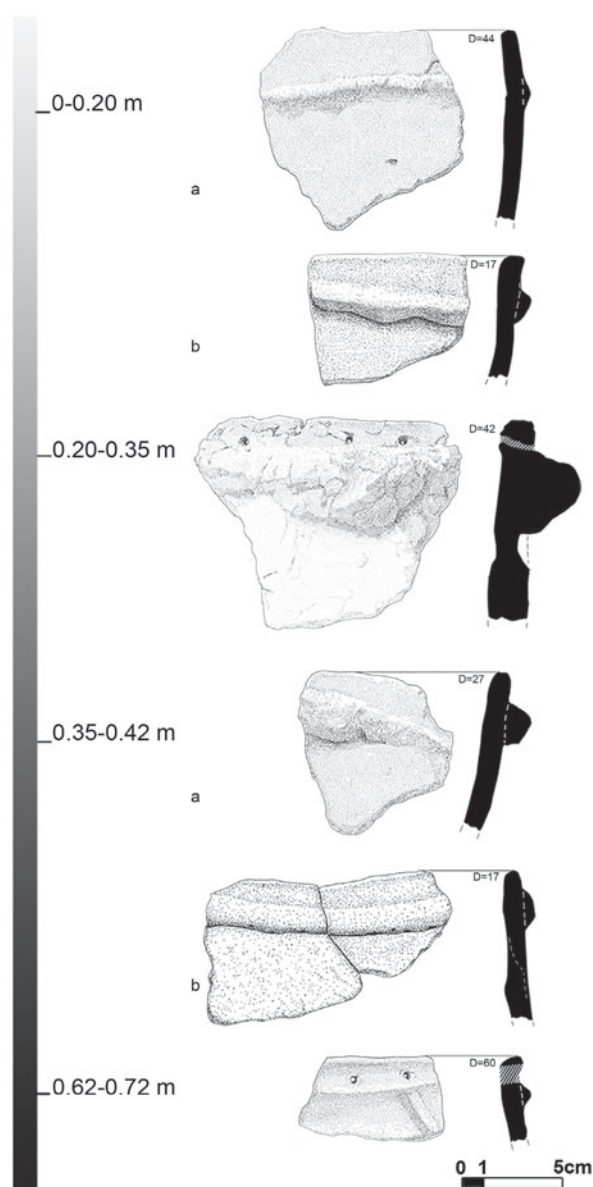


Figure 4.39. Pithoid rims with plain band decoration. Form development and find depth (0–0.72 m).

Among the fragments from B1, the base/wall join usually forms an acute angle (e.g., depth: 0.20–0.35 m), while in some cases the join of the base with the first coil of the wall is exceptionally distinct (Gr34/D11959).

Many handles and knobs recovered come from pithoi, but their precise location on the body is unknown due to the fragmented state of the material. In the few diagnostic examples, they are found on the upper part of the body, near the mouth.

Fabric

The surfaces are reddish-orange to brown in colour, with rudimentary burnishing, and so porous, often crackled, with clear traces of the burnishing tool and organic imprints. The roughness of the surface treatment and the

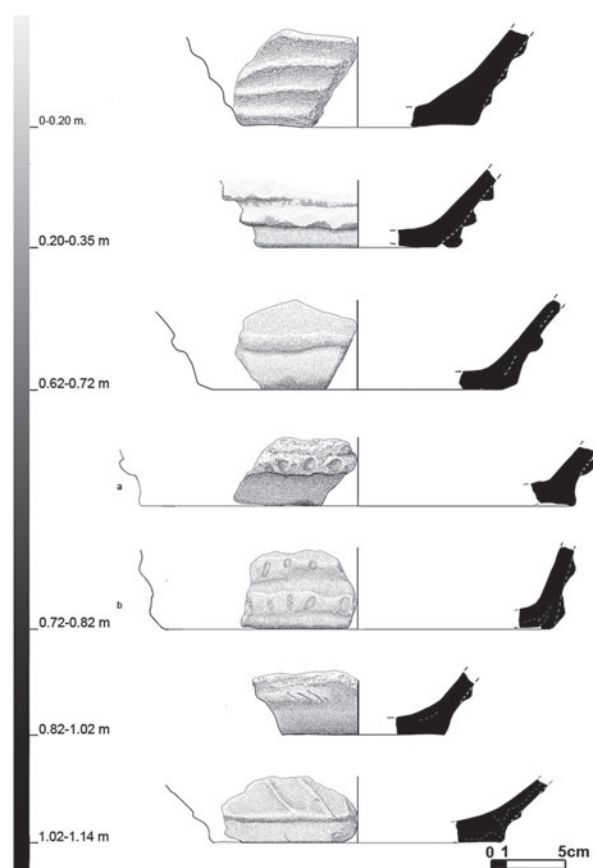


Figure 4.40. Pithoid bases with rope and plastic decoration. Form development and find depth (0–1.14 m).

absence of slip indicate that the pithoi were most probably used as dry storage vessels. They were coil-built, with the coils attached slantwise on the inside or outside of the wall, as we can see from the clear sections of certain sherds, where the lateral join of the bands is visible. The pithos core is bipartite, indistinct or sandwich-type, and in many cases of uniform colour and with a high ‘relief’ at the sections. The fabrics contain large and medium-sized inclusions, sometimes visible on the surfaces. Calcareous clays are typical, appearing at a depth of 2.60–2.75 m and continuously increasing to the uppermost layer. Indeed, a specific orange calcareous fabric with many large, rounded limestone inclusions is used throughout LN II. Two pithos samples from depths of 0.35–0.42 m and 1.20–1.30 m were subjected to petrographic analysis in the pilot analysis programme. They were placed in the fabric of ‘Group 2’ (Pentedeika, this volume), extremely common for LN II monochrome vessels and pithoi, which even includes ‘clay pellets and grog fragments, along with a few low metamorphic flysch-related rock fragments’, closely matching the geological formations of the wider environs of the cave.

Decoration

The decoration of the pithoid vessels is always placed on the relief bands, rarely directly on the surface of

the clay as is the case in later periods. Rope decoration consists of relief bands on the body of the pithos, bearing a row of impressions. Generally speaking, both types of decoration used, rope and plain relief bands, are thought to imitate an original binding around the pithos for ease of transport. A purely technical, but most interesting, interpretation is that the bands prevented deformation of the vessel during its drying out after manufacture, just as strips of leather or cloth were later tied around pithoi (Pilides 2000, 103), and that the impressions arose from the potter’s attempt to attach the band to the body of the pithos by pressing on the still-soft clay (Vitelli 1999, 70). Whatever the case, the bands made the pithoi more durable and concealed the joins (Kyriatzi 2000, 56; Giannopoulou 2010, 67), while the impressions helped attach the band firmly to the vessel. Perhaps they originally had a purely technical purpose, only subsequently becoming decorative; both functions could operate at the same time, of course.

A. Rope-motif decoration (Figure 4.41)

The width and thickness of the bands varies, but generally in the samples from B1 it ranges between 1.1 and 1.9 cm with a thickness of 0.28–0.7 cm. The bands are usually triangular in section, curved or, more rarely, trapezoid. The impressions were made with the fingers (fingerprints are particularly visible in some cases), or with an instrument with a rhomboid tip. The impressions are regularly spaced; the points at which they were to be applied were probably marked out before the final decoration. The shape of the impressions varies (ellipsoid, circular, elongated, rhomboid) and they are 1–2 cm wide. In most cases the impressions are vertical, with a few horizontal or slanted examples (*e.g.*, depth: 0.72–0.82 m), producing a more realistic rope-like effect.

Rope decoration seems to have evolved very slowly over time, as regards both shape and decorative motifs (Sampson 1993, 154), which must indicate the longevity of the vessel form. Tracing this evolution is hindered by the fact that the full ornamental patterns are very difficult to reconstruct, since only small sherds survive (Valvis, this volume). With regard to the shape of bands and impressions, however, the material of B1 allows some preliminary observations based on the finds by layer, remembering though that some areas are disturbed (Papathanasiou, Chapter 2 this volume). Thus low and narrow bands are found in the deeper and middle layers (depth: 3.28–3.43 m). Wide bands with double impressions are also found in the lower levels, ceasing at a depth of 1.85 m. The triangular-section band (usually carefully formed), with deep vertical impressions and acquiring a prismatic section between the impressions, is an interesting and distinctive case. The type diffidently appears with five examples at a depth of 2.80 m (Gr83) to 1.45 m, then may acquire very acute angles and predominates throughout LN II, from 1.25 m to the surface (*e.g.*, depth: 0 to 0.72–0.82 m, *a*).

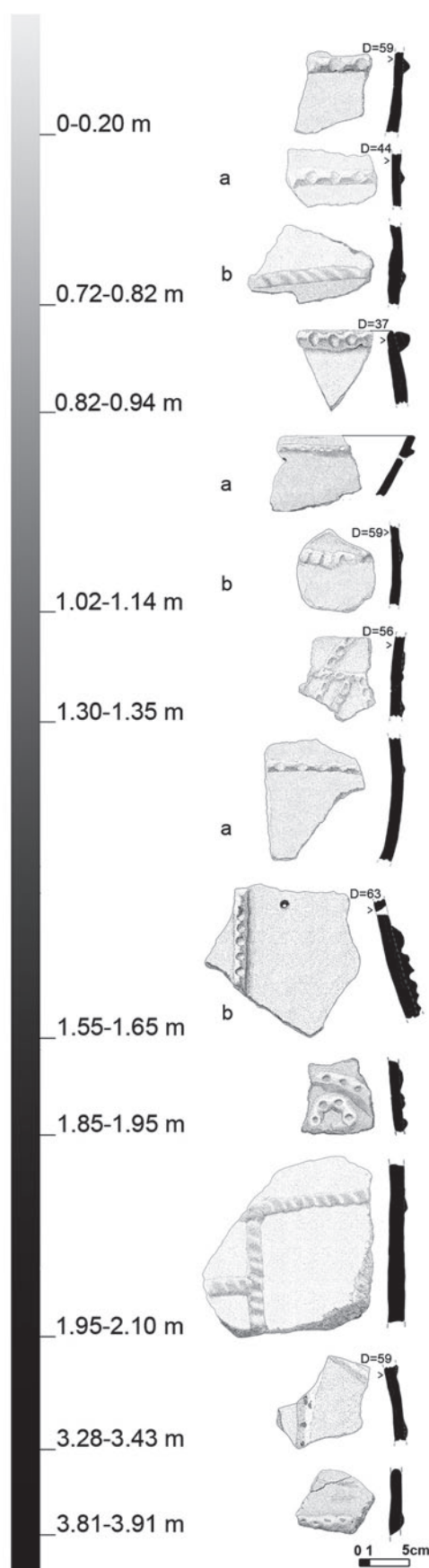


Figure 4.41. Pithoid vessels with rope decoration (depth 0–3.91 m).

Generally speaking, the upper layers present great variety but a more careless rendition, a feature matched at other sites (Sampson 2008, 214). The slanted impressions that give a much more realistic imitation of rope decoration are few (0.72–0.82 m) and found up to 1.10 m. Decoration with incised cordons/slashed cordons (Gr16/D1025) is considered later in date (Phelps 2004, 116); this holds true in B1, as the sherds, again few in number, were found in LN IIa/b.

Regarding the number of bands on the vessels and the overall decorative pattern, our information on the B1 material is partial, as there are no intact vessels at all. Although the sherds from B1 present a consistency of decoration, the larger ones do indicate an organised pattern, as we can see from a few almost intact examples from the North Sector and, above all, from the plethora of sherds from all parts of the cave (Valvis, this volume). Although the pattern must take account of the shape of the vessel (Christakis 2005, 31), it appears that more bands encircle the vessel from the centre of the belly up. However, examples of bands low on the base are frequent in B1 (Figure 4.40). The largest proportion of sherds from B1 comes from horizontally-placed bands, with only very few examples of oblique, vertical or curving ones (5%). It is interesting to note that no curved motifs are found in B1 above 1.0 m. Two good examples of an open, probably single spiral were discovered at a depth of 1.85–1.95 m. Finally, it must be noted that many sherds, mainly from the walls of pithoid vessels, were turned reworked into tools (depth: 0.82–0.94 m, 1.02–1.14m, b).

B. Plain Relief band decoration (Figure 4.42)

The second type of pithos decoration is simple raised bands, triangular or curved in section. Some of these may form part of a pattern (with rope decoration and raised bands, e.g., depth: 1.30–1.35 m), as we can see from complete pithos specimens from the cave (Papathanassopoulos 2011, 163). Most sherds B1 bear plain bands, horizontal, vertical, oblique, some are crossed by other oblique or vertical bands. Generally speaking, the ornamental patterns of the plain relief bands are more varied and versatile than those with the rope decoration, with a higher density of bands. Curved patterns are rare, but slightly more frequent than with the rope decoration (21 examples, e.g., depth: 1.55–1.65 m). The bands are 0.1–1.8 cm wide and 0.3–0.9 cm high. They are placed similarly to rope decoration, that is preferably on the belly of the pithos but reaching low on the base in several cases (Figure 4.40).

Dating

It is generally accepted that rope band and plain plastic decoration of pithoi is common and popular at most sites during LN II (Final Neolithic). Examples of rope decoration seem to appear much earlier, for instance at Sitagroi, dated to Phase I (5,500–5,200 BC) (Renfrew 1986, 347, 348, 350, figs. 11.2:6, 11.8:1, 11.7:1, pl. xlv. 4), albeit in small

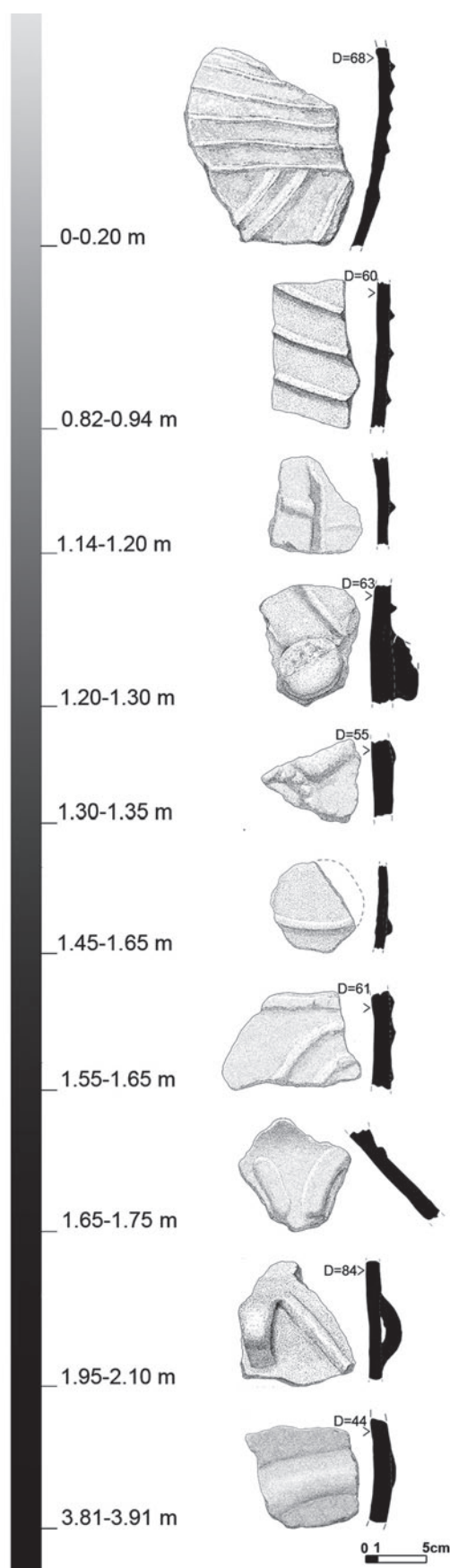


Figure 4.42. Pithoid vessels with plain plastic decoration (depth: 0–3.91 m).

quantities and in non-coarse-ware categories, and at Arapi Magoula (Hauptmann and Milojcic 1969, pl. xi). In any case, this decoration appears to become established as early as LN Ib, with many examples from sites such as Tharrounia (Sampson 1993, 286), Kastria (Sampson 1997, 225–232, figs 64, 66–70), Pefkakia, Volos (Weisshaar 1989, p. 173, pl. 34. 3, 4, 8), Ftelia on Mykonos (Sampson 2002, 81), and the Cave of the Cyclops (Sampson 2008, 58–59, fig. 2.37: 641, 641.1, 2.38: 642–648).

The first pithos sherds with rope and raised band decoration (4 examples), appear very early in Trench B1 (beginning of LN I), at a depth of 3.40–3.91 m. They appear sporadically from there up to 2.80 m, increasing substantially from 2.80 m upwards (Gr82), in layers placed by absolute dating at the latest in the beginning of LN Ib. We must first take into account the fact that part of the LN Ib stratigraphy presents evidence of disturbance in places (Karkanas, this volume for chaotic mixing of fills), although the excavation data do not corroborate that this occurs throughout the trench. However, the lack of precise excavation data on the exact findspots of many of these sherds makes it difficult to draw secure conclusions. Nevertheless, we should probably accept an early appearance of rope decoration in Alepotrypa Cave, as, even if the first four sherds are intrusive, the LN Ib samples are particularly problematic, numbering as they do 105 sherds in total.

A sudden increase in pithos numbers occurs from 1.90 m to the surface. In the final metre, sherds with both types of decoration almost triple in quantity compared to the previous layers, where they were already on the increase. Their construction is now more careless: the walls are often thinner, the surface treatment is rougher and the wear more pronounced.

Finally, as regards the examples of plain relief decoration, in B1 they do not seem to appear later than rope band decoration (Phelps 2004, 116; Sampson 1997, 228) but rather just as early (depth: 3.81–3.91 m), although with clearly fewer specimens (2). They seem to match the pace of increase noted for rope decoration, though always in lower numbers, in a ratio approaching 1:3.

To summarise, based on its absolute dating, Trench B1 currently seems to show that pithoi appear in LN Ib, begin to increase towards the end of the period, increase astonishingly towards LN IIa, and explode in numbers in LN IIb, forming one of the basic vessel types.

Handles and lugs

Trench B1 produced a relatively large number of handles and lugs, mainly from coarse and semicoarse wares in all layers, with a higher concentration in the upper strata due to the increase of the appropriate pottery forms.

The categorisation into handles and lugs follows Diamant's clear definition: a lug is a piece of clay attached to the vessel whole and then pierced (or left solid), while a handle is a piece of clay that is attached from the outset only at its two

ends (Diamant 1974, 36). There were only a few exceptions that proved difficult to identify or were ambiguous, such as false handles and handle lugs (see below).

A. Handles (Types A1–A8)

Of the 387 handles from B1, the majority (86%) are vertical strap handles. False handles (5%) and tubular handles (4%) follow at much lower percentages, while the remaining 5% consists of handles with circular section, a few very rare flat handles, and animal handles.

A1 (Figure 4.43)

Vertical strap handles predominate in all the layers of B1 (Figure 4.43), as is the case at all Neolithic sites. Their height, width and the shape of their sides (straight or curved in profile) determine their final typology. The highest percentage (91.5%) consists of wide strap handles 3.5–7.0 cm across, while 7% are medium handles (under 3.5 cm wide), and a tiny percentage (1.5%) consists of microscopic strap handles. They are oval or flat convex in cross-section.

Although it is relatively hard to determine the evolution of their typology with clear chronological differentiations, especially since many are handles of pithoid vessels that evolve slowly through time, there do appear to be certain differences, at least as far as the B1 material is concerned. The outward projection of the handles in profile is generally balanced; the trend of raised or hanging handles as seen in the immediately succeeding EH strap handles is not observed, apart from three examples from the upper layers, which are slightly slanted. The strap handles from the lower layers, apparently corresponding to LN Ia/LN Ib, more often have straight, parallel or slightly curved sides (depth: 2.75–2.80 m), while in the upper layers (LN II), strap handles with slightly or strongly curved sides ('butterfly' type, *e.g.*, depth: 0.72–0.82 m) increase substantially. In the lower layers (LN I), wide handles are frequently medium or small in dimension, becoming wider and over 5 cm high in the LN II strata (*e.g.*, depth: 0–0.20 m), a differentiation also influenced by the appearance of larger storage vessels. Finally, handles with strongly raised side-edges (so forming a hollow in the back of the handle; depth: 0.50–0.62 m) become more frequent in the upper layers (LN II).

The material collected from B1 included three winged strap handles of looped cross-section, rising from the rim. The most characteristic is Gr14/D4585, depth: 0–0.20 m, which was found in the uppermost layer and is dated to the end of LN IIb; similar examples have been found in other parts of the cave (Phelps 2004, 119, fig. 58.4, rising above the rim). The other two handles from B1, though shorter, come from deeper layers, one dated to the middle and the other to the end of LN IIa. Parallels for such winged handles are found at various sites such as the Cave of Euripides (Mari 2001, 140, figs 77, 97) dated to FN, or Palaia Kokkinia, Piraeus (Theocharis 1951, 108, fig. 22, rising above the rim).

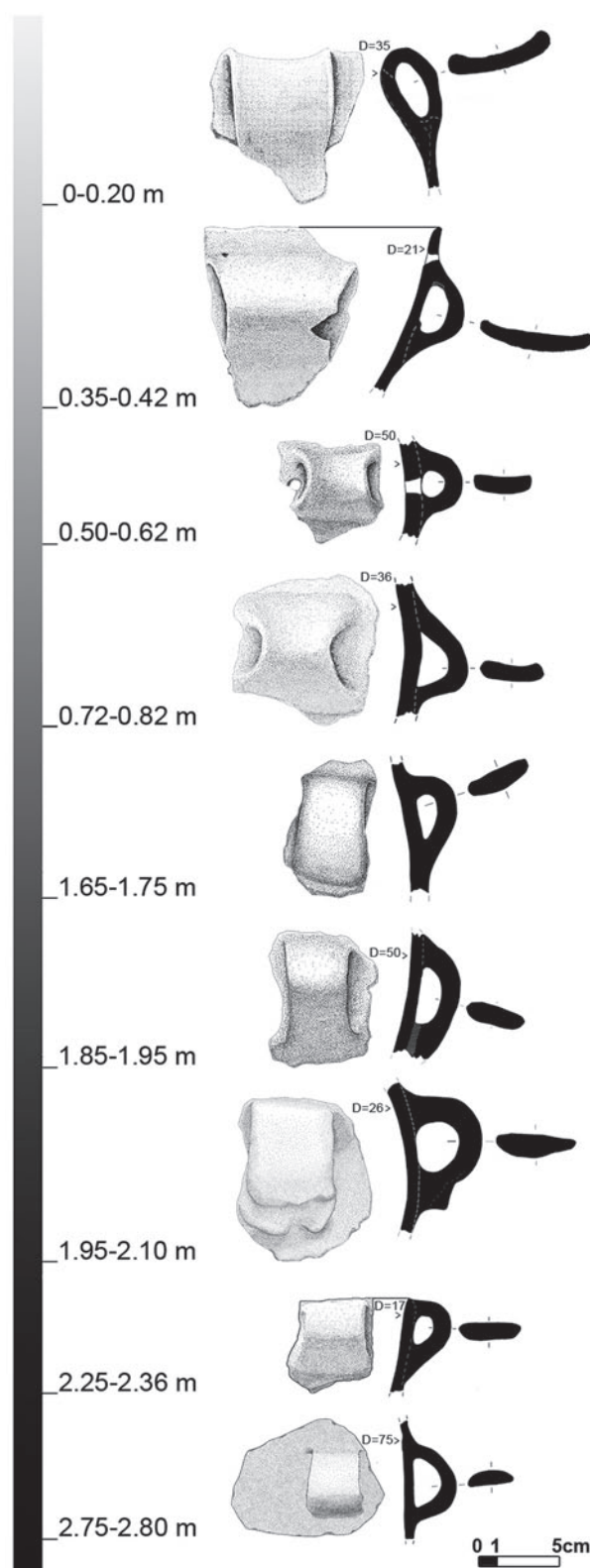


Figure 4.43. Vertical strap handles (Type A1). Form development and find depth (0–2.80 m).

Handles with ledge lug (Figure 4.44). Special mention should be made of 16 fragments of handles with a low, wide lug at their base. These are vertical strap handles

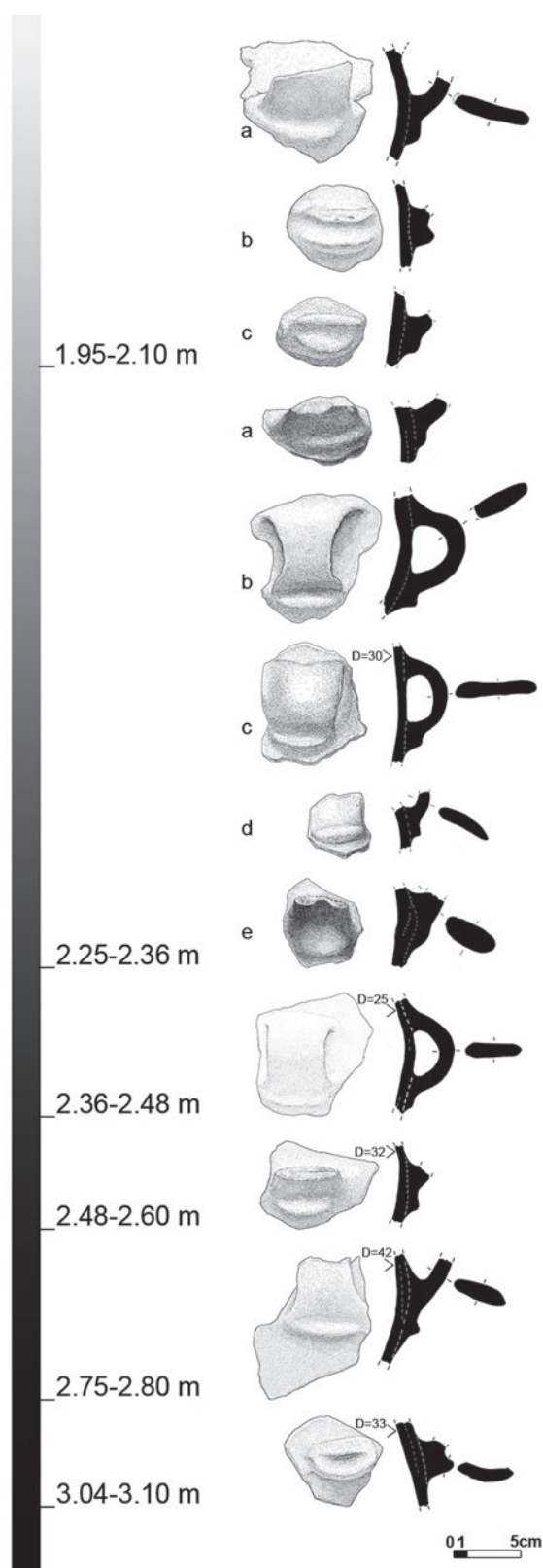


Figure 4.44. Handles with lug (depth: 1.95–3.10 m).

from closed semi-coarse ware vessels, 24–43 cm in diameter: each has an elongated clay attachment at the base, usually oval in outline, extending the full width of the handle. The lug is curved in section or, more

rarely, acute. The surfaces are well smoothed or medium burnished, often showing sooting, cracking and crusting on the outer surface. The clay is hard with many large inclusions, while the core is often bi-coloured, forming a high relief at any broken point. These handles are often remade into circular tools (depth: 1.95–2.10 m, *b, c*). A variation on this type may be the handle with double tongue (Figure 4.43, depth: 1.95–2.10 m) (for similar at Tharrounia, Sampson 1993, fig. 176:10, phot. 145). The type of handle with lug is correctly argued to be a local Diros fashion (Phelps 2004, 104), being very well known in the cave from a large number of examples in Chamber Z.

Handles with a ledge lug attached to the underside – as opposed to the common LN handle type with a knob or lug on the upper side – are few. Examples are mentioned from the Athenian Agora, all slightly different as to length, shape of lug, ware (red burnished) and vessel type (carinated bowls) (Immerwahr 1971, pls 4.49, 68.47), with just a single coarse ware example (Immerwahr 1971, pls 13.189, 69.189). The type is also found in a few pieces of coarse ware from Pefkakia Magoula (Weissshaar 1989, 45, pls 12.15, 13.11, 136, typ. 233), dated to the Rachmani phase (unteres Stratum), while the material from Emborio, Chios, dated to periods V–IV, is also very similar (Hood 1981, 417, pls. 78 (b)5, 79 (a)1). The late handles with a moulded disc on the underside (EBA) may be a development of the type, as are examples from Thermi, Lesbos (Lamb 1936, 91, fig. 31 and Blegen 1950, pl. 240.17).

The Diros handle type is dated by Phelps to the early phase of Period IV (Phelps 2004, 114, fig. 51.30, pl. 101.17), a dating matched by the examples from other sites, going down as far as the transition to the EBA. However, the data given by the B1 material differs, as the earliest examples were located at a depth of 3.10 m (about 4,800 cal BC). Their largest concentration is at a depth of 1.95–2.25 m, while no examples were found after 1.30 m. Based on the absolute dating, these examples from B1 put the presence of these handles in LN Ia/LN Ib, disappearing in LN II, perhaps even late LN IIa. However an issue concerning the dating and stratigraphy in Trench B1 attaches to these handles, at least in the layers of the large concentration, namely one of synchronisation. The associated ceramic finds – cheese pots, pithoi with moulded and rope decoration, monochrome burnished ware and straw impressions – have undoubted LN II connections. It would be safer, for the time being, to argue that, at least in the area of B1, these handles seem to appear early (end of LN Ia) and on no account go on into LN IIb.

A2 (Figure 4.45)

The trench produced at least 15 false handles (Figure 4.45). These are only conventionally included in the handles, since they actually follow the lug technique in having

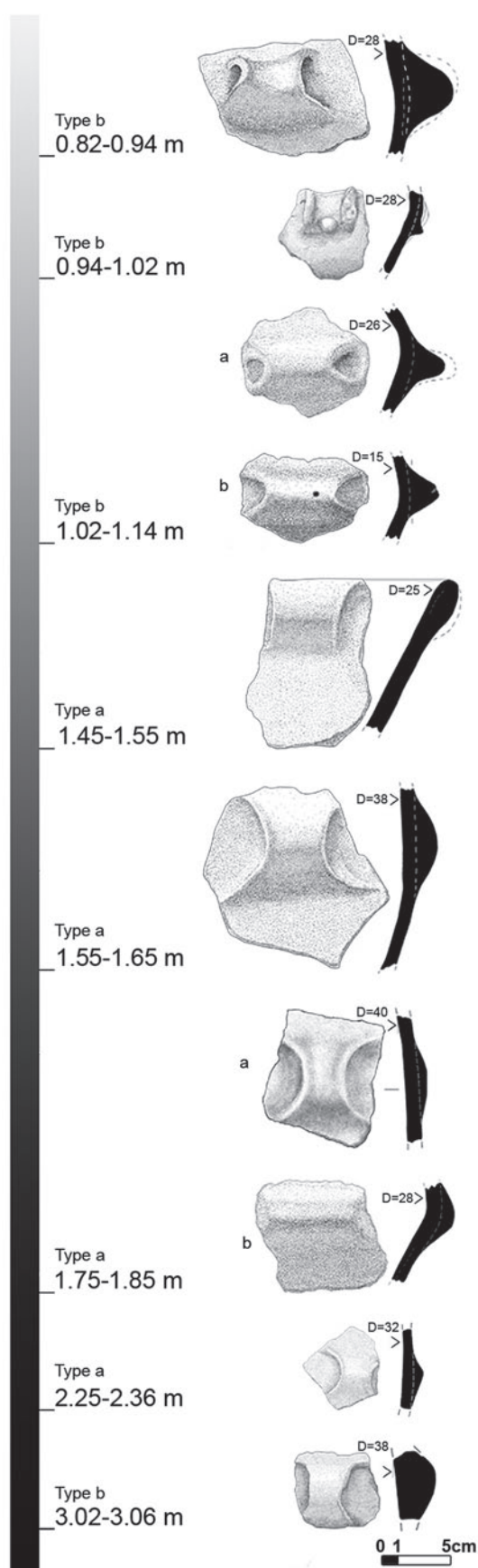


Figure 4.45. False handles (Type A2). Form development and find depth (0.82–3.06 m).

the main body completely attached to the vessel wall. Although there is no consistency of shape, we can distinguish two main types: type *a* consists of solid handles, while type *b* has handles with a blind piercing on the longitudinal axis (the clay is pinched in and thinned, without an actual hole developing).

Type *a* is represented either by low handles with curved ends of the wall (e.g., those at depth: 1.45–1.55 m, 1.55–1.65 m), or by elongated lugs reminiscent of tubular lugs (e.g., depth: 1.75–1.85 m).

Most examples of Type *a* are early in date (see Figure 4.45 for in-depth presentation of Types *a* and *b*). All were found at depths of 1.55 to 2.36 m and are dated to the end of LN I or the start of LN II. False handles have been found at several sites, such as the Sarakinos Cave (Sampson 2008, 181, fig. 98.584), Palaia Kokkinia, Piraeus (Theocharis 1951, 107, fig. 20), and the Kastria Cave (Sampson 1997, not depicted).

The false handles of Type *b* include an early specimen (depth: 3.02–3.06 m) dated to LN I. It is the oldest of all the false handles, unique in its type, and looks very similar to free strap handles. But the other Type *b* examples appear later than Type *a*, in LN II, and resemble tubular handles (see depth: 1.02–1.14 m), an exception being the handle with a knob in the centre of the underside (depth: 0.94–1.02 m). This last resembles a particular type of handle, that with a knob, which is generally absent from Alepotrypa (with very few exceptions: see section ‘handles with lug’). Only two examples with the knob attached to the underside were found in B1, dated to the end of LN Ib/LN II (0.94–1.55 deep).

A3 (Figure 4.46)

Tubular handles are varied in typology. Some resemble lugs and it is not always easy to differentiate between them. For this reason, despite Diamant’s categorisation, some examples are termed handle lugs due to their size (Zachos 2008, 25).

Three types of tubular handle lug are distinguished in the material from B1 (Figure 4.46): *a*) cylindrical (diam. 2.5–3.5 cm) often elongated, resembling well-formed tubes with vertical or slightly incurved ends (depth: 1.02–1.14 m, *a*–*c*); *b*) tubular, with large holes and compressed ends strongly waisted (depth: 1.30–1.35 m, *a*); and *c*) small horizontal cylindrical (diam. about 1.5 cm) with flattened slanting ends, waisted or not, usually attached to the rims of bowls, often rolled-rim ones (depth: 0.94–1.02 m, *a*, *b*).

The type with short, squat tubes is considered earlier than the elongated and waisted type (Phelps 2008, 119); it is generally noted in B1 but the limited number of samples does not allow us to confirm the differentiation. The later long, horizontal tubular lug handles, flat or slightly curved, are particularly important for dating, being one of the basic dating elements of the transitional phase from LN IIb to EH in Southern Greece. Their significance is enhanced

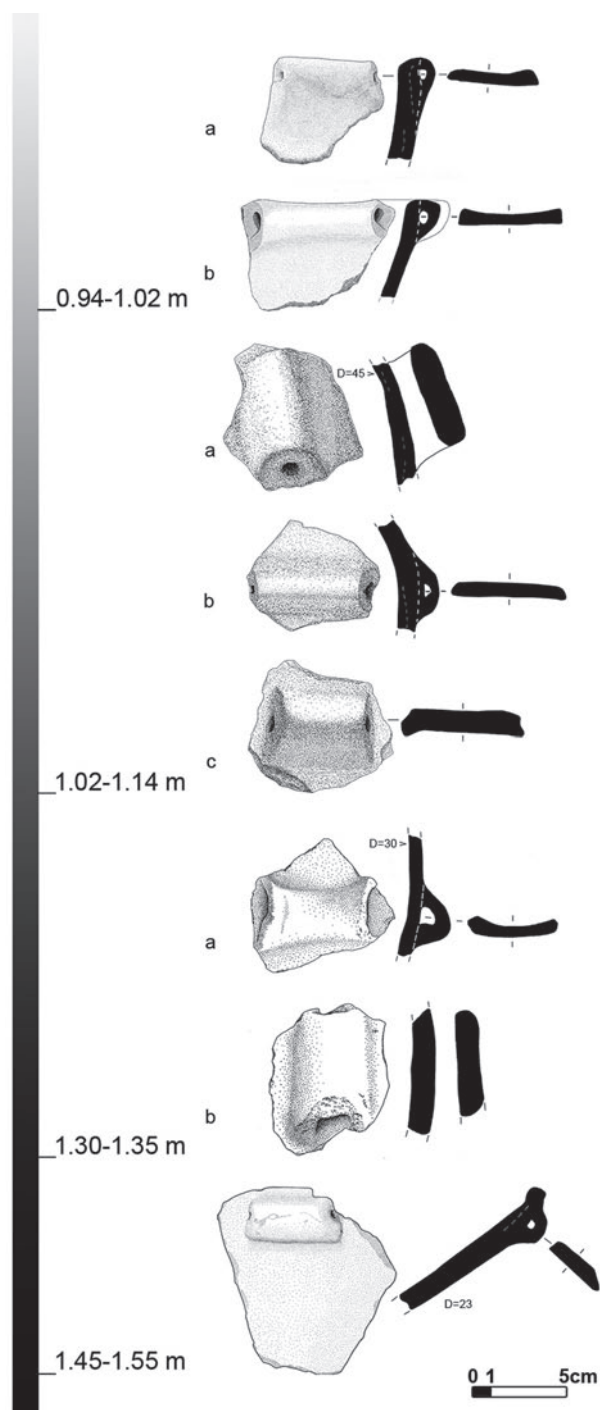


Figure 4.46. Tubular handles (Type A3). Form development and find depth (0.94–1.55 m).

by the fact that they often accompany rolled-rim bowls, attached to the rims or lower down (see section on rolled rims) (Hansen 1937, fig. 2a, b; French 1964, fig. 9:4.5). Similar handles from the end of FN and the transition to EH are mentioned from many sites of mainland Greece (see Johnson 1999, 325). Only two samples from B1 can be securely placed in this category, although they differ with regard to their thin section.

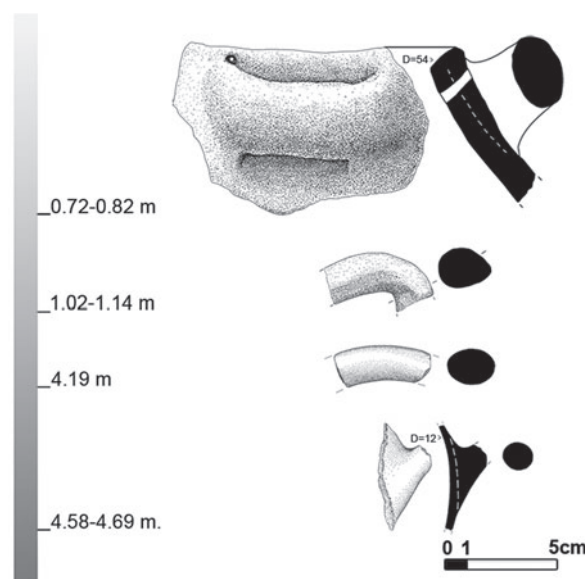


Figure 4.47. Handles with circular section (Type A4) (depth: 0.72–4.69 m).

Generally, the tubular lug handles of B1 are found at a depth of 0.94–1.45 m, corresponding to LN II, but none was found in the upper layers dating from the end of LN II.

A4 (Figure 4.47)

Handles with a circular section (Figure 4.47) are very few in B1, and in any case not generally numerous in the cave (Papathanassopoulos 2011, 179; Phelps 2004, 119, figs 60.2, 98.3, 101.6, also from Alepotrypa). The most representative handle, Gr22/D1261 (depth: 0.72–0.82 m), is large and attached horizontally below the rim of a wide-mouth pithos. It belongs to the horizontal bar handles prefiguring the corresponding Early Helladic type, and was found in a layer dated to LN II. The other circular-section handles in B1 are of a different type; three of them come from deep layers and date from the MN (depth: 4.58–4.69 m) and the very beginning of LN I/MN (depth: 3.81–3.96 m, not depicted here, and 4.24 m probably belonging to an Urfinis vessel).

A5 (Figure 4.48)

At least five handles are bar-shaped with very straight sides and flat-convex in section (Figure 4.48). We know neither the precise handle type – whether it may have been bent at an angle – nor the vessel type. They probably belong to the type of handle with transverse struts/small braces, as attested by examples from the cave (Papathanassopoulos 2011, 223, 224). Handle Gr30/D4394 definitely belongs to this type, as it preserves the stump of a transverse element at the lower end. It has brown, highly burnished, glossy surfaces and one end is free. More fully preserved examples, on larger vessels, are found at various LN sites (such as Tharrounia, Sampson 1993, 159–160 drawing 170–171, photo 145 and Franchthi, Vitelli 1999, 81,

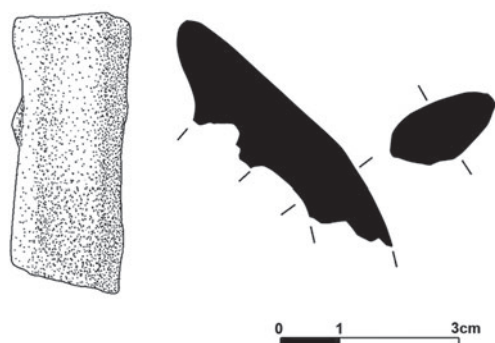


Figure 4.48. Bar-shaped handle (Type A5) (depth: 1.35–1.45 m).

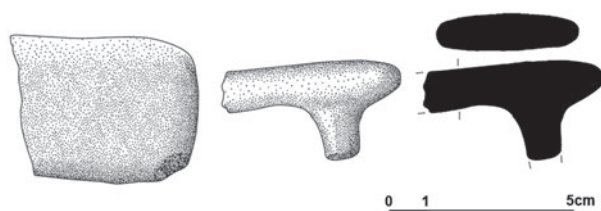


Figure 4.49. Rectangular handles (Type A6) (depth: 1.85–1.95 m).

fig. 68i), although the example from B1 is remarkable for its unusually small size. At Tharrounia, strut handles appear in the early part of LN II, a dating which is reasonably compatible with that of the B1 examples (LN IIa).

A6 (Figure 4.49)

Large, flattened rectangular handles with free ends (Figure 4.49) are very rare (3 examples). On the inside they have a vertical strut joined to the body of the vessel, like bar handles. The surfaces are reddish-brown and burnished to a high gloss. Similar handles from other sites come from large pithoid vessels and are placed on the shoulder, as in the case of the pithos from Sakovouni/Sfakovouni (Spyropoulos 2012, 258, fig. 497). The B1 handles come from a depth of 1.85–1.95 m, corresponding to the LN Ib period by absolute date.

A7 (Figure 4.50)

Animal handles and lugs (Figure 4.50), although not frequently met with in the pottery material, seem to have been a popular type at Alepotrypa (Papathanassopoulos 2011, 210–213). B1 produced at least five examples; there are also five possibilities which, however, are so strongly stylised that their identification as animal shapes is risky, though not out of the question. The most characteristic are Gr48/D232, depth: 1.85–1.95 m and Gr29/D637, depth: 1.30–1.35 m. They come from burnished and relatively well-made vessels and are dated to LN I/LN II.

The former is a very vivid depiction of an animal, perhaps in a heraldic attitude, with clearly indicated head and limbs. The latter has a body shaped like a tubular handle, with stubs on one narrow side for the legs, and simple triangular protrusions for the horns and tail.

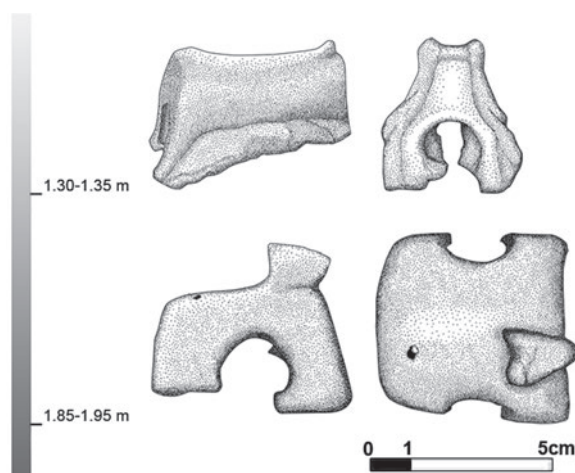


Figure 4.50. Animal handles (Type A7) (depth: 1.30–1.35 and 1.85–1.95 m).

B. Lugs (Types B1–B5)

Trench B1 produced 434 lugs from coarse, semi-coarse and semi-fine ware. Lugs are placed on vessels in pairs, although large vessels such as straight-sided jars (kadoi) often have four lugs (see intact examples from other spots in the cave, Papathanassopoulos 2011, 176). No matching pairs, though, were found in the material from B1. Of the lugs, 86% are unpierced, while 14% have a transverse or vertical hole. Pierced lugs seem to have had an additional function in the handling the vessels, either from attaching strings through the holes or by passing sticks through them for lifting, *e.g.*, in the case of hot vessels (Vitelli 1993, 103, n. 11).

B1 (Figures 4.51–4.53)

The main lug type in B1 is the solid tongue-lug (Figure 4.51). These are of various shapes and sizes, and are attached horizontally, and rarely vertically, to the walls of the vessel. They range from 1.5 to 3 cm in thickness and from 3 cm to 6 cm in width, projecting out some 2–3 cm from the walls. Their outline is usually crescent-shaped (depth: 3.68–3.80 m), less often triangular (depth: 1.75–1.85 m), and in a very few cases square (depth: 1.45–1.55 m); they are generally ellipsoidal in section. Long and narrow, fine lugs are very few (depth: 1.14–1.35 m) and appear in LN I/II. In some cases, these latter are deeply curved (crescent-shaped), like the lug found at a depth of 1.85–1.95 m.

All of the lugs are attached to the walls of the vessels, with a few slightly below the rim (depth: 2.36–2.48 m). Most project horizontally, while a few are slightly or deeply upturned (depth: 3.46–3.66 m), or more rarely the opposite (depth: 3.75–3.80 m).

Many lugs were found detached from their vessel walls, indicating wear from frequent use and, in some cases, poor attachment, as they appear to have come away when the vessels were lifted — always a possibility when a pot is full and heavy (Vitelli 1993, 100).

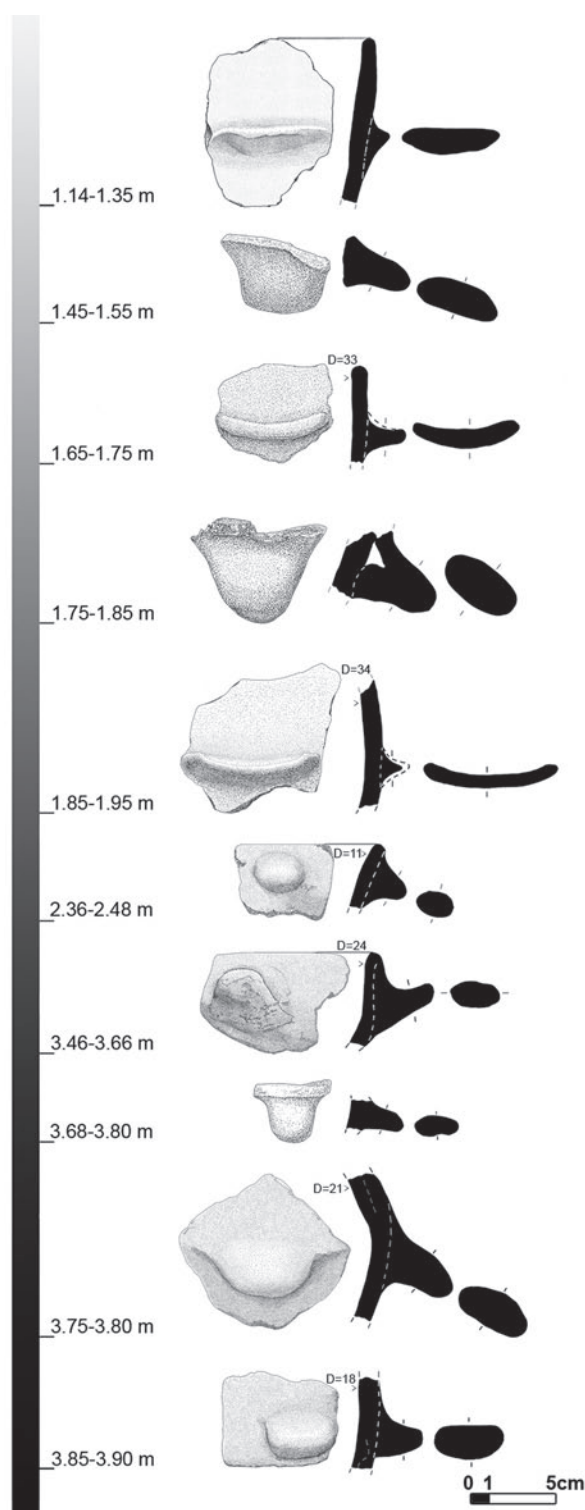


Figure 4.51. Tongue-lugs (Type B1). Form development and find depth (1.14–3.90 m).

The detached lugs do assist in the understanding of their construction techniques. They are generally made of a single piece of clay that is attached to the vessel and then formed into the desired shape. In some other cases (such as the specimens of Figure 4.52), the central core is enveloped in another layer of clay, by which

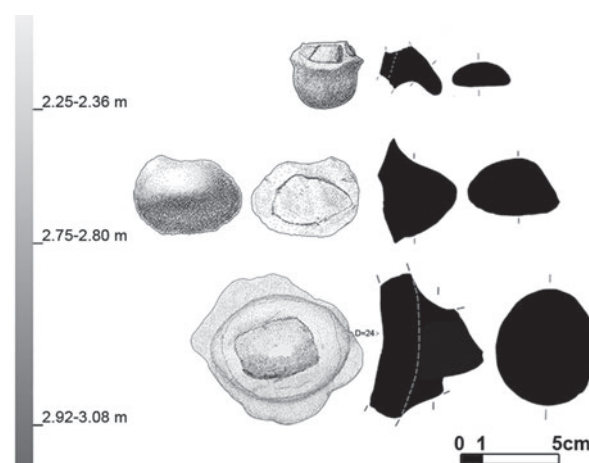


Figure 4.52. Handles produced by the core technique (depth: 2.25–3.08 m).

the lug acquired its final shape. It is not uncommon for lugs to be reused as tools, of a circular or square outline (Figure 4.51, depth: 3.85–3.90 m), as the projecting lug makes a perfect handle.

The first tongue-lugs appear very early in B1, from early LN Ia (3.98–4.05 m deep), and continue without interruption to the surface of the fills. Their development is very gradual. Both upswept and downturned lugs are found from the early LN I layers onwards, as at other sites, down to LN IIB. Square lugs, which usually appear in LN Ib and the early part of LN II (Sampson 1998, 191, drawing 56.119, 181 and 1993, 114, 116, figs 117.10, 118.12–15), are found quite early in B1 (LN Ia) and continue until LN IIA. Finally, crescent lugs, which appear at other sites during the LN I–LN II transition (Sampson 1993, 114, pl. 111.6, 7), also appear in B1 in the same period.

A few lugs have a horizontal or more often vertical hole (Figure 4.53). The earliest sort is elongated and is pierced with two well-made vertical holes. Examples of a somewhat comparable similar type – though with three holes – and matching date (LN Ia) are found at sites such as the Cave of the Cyclops (Sampson 2008, fig. 2.33: 534) and Pefkakia Magoula (Weisschaar 1989, pl. 12.8), although they are typologically prefigured in the Middle Neolithic (Vitelli 1993, fig. 47j). In B1 they survive, obviously with differences in size and type, until LN IIB (depth: 0.42–0.72 m). One example that stands out, as it is not a common element in B1, is an arched lug with a hole at the top of the arch and curved ends to the wall (depth: 1.55–1.65 m); it is from a monochrome burnished bowl. In B1 they are dated to the end of LN I and in LN II, although examples are also found at an earlier date elsewhere (Sampson 1993, 104, fig. 95).

B2 (Figure 4.54)

The next most frequent type of lug is the indented lug (Figure 4.54). These resemble tongue-lugs, the difference being that they have an indentation at the top. They vary

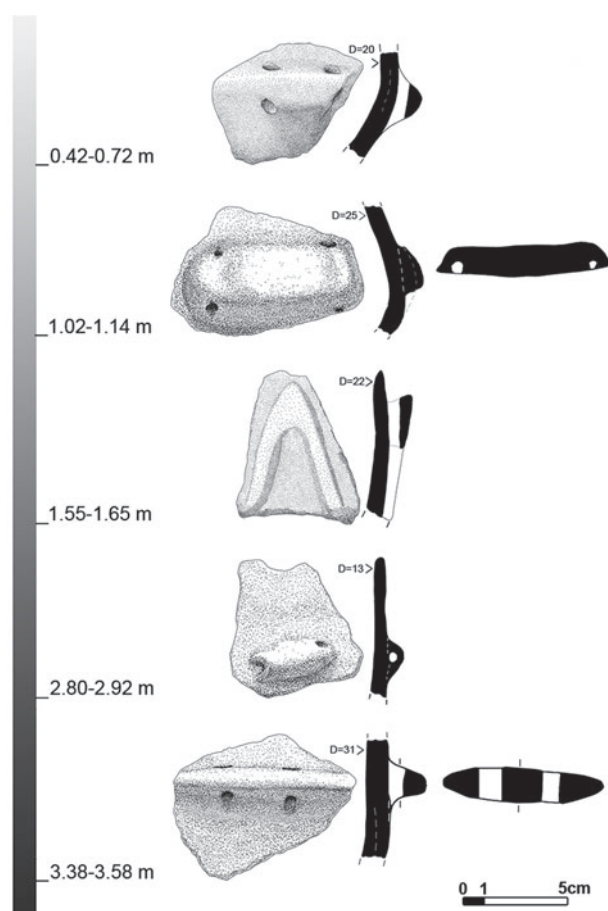


Figure 4.53. Pierced lugs (depth: 0.42–3.58 m).

from 4 to 6 cm in length and 1.50–3.0 cm in height, and project out 1–3 cm. All come from vases of coarse or semi-coarse wares; they are attached on the body or a little below the rim. The indentation may be curved, wide and shallow (depth: 1.95–2.10 m, *b*), or angular, narrow and deep (depth: 1.02–1.14 m). They usually project out horizontally. A variant is the large, thin lug with a deep, well-formed indentation, strongly upswept (depth: 1.95–2.10 m). This type is represented by the *kadoi* (straight-sided jars) from the cave with four such lugs (Papathanassopoulos 2011, 176). Indented lugs in B1 only rarely have double indentations, like the sherd at depth 0.82–0.94 m. Some have been turned into tools (1.14–1.35 m), like the corresponding tongue-lugs.

Indented lugs usually cover the late LN I and early LN II (Sampson 1993, 194–195, and 1997, 114). In B1, indented lugs are contemporary with simple tongue-lugs. They seem to appear early (LN Ia, 763, depth: 4.23 m) and last longer, reaching as far as the surface layers (late LN IIB).

B3 (Figure 4.55)

Circular lugs (Figure 4.55) vary in size and shape, forming either *a*) simple, semi-globular nipples (65%) or *b*) large buttons with tops of various sorts, curved, flat (30%) or slightly indented (5%).

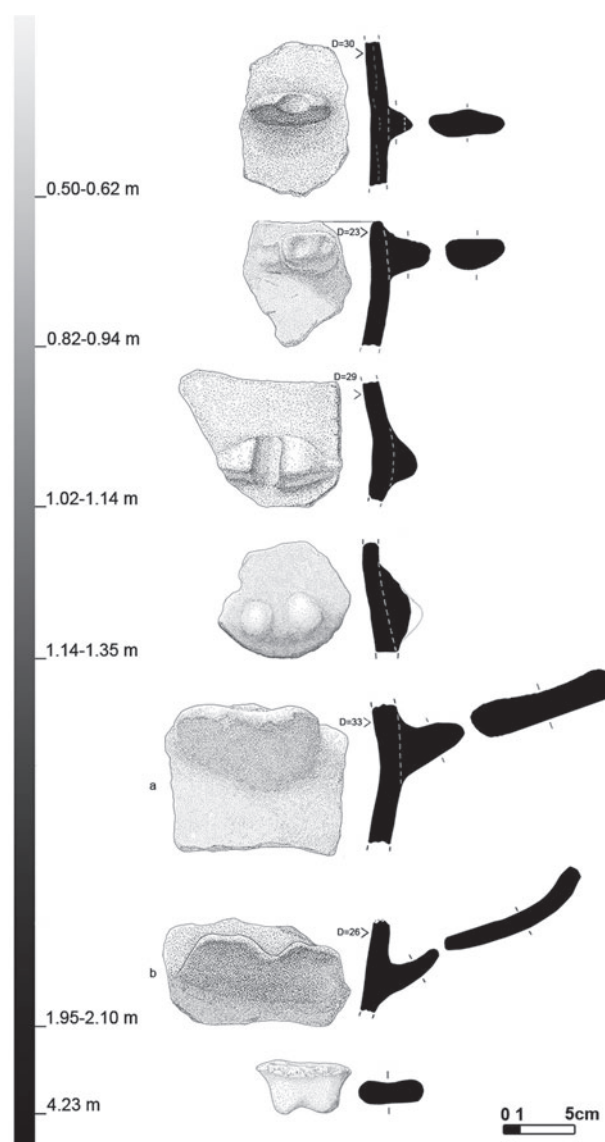


Figure 4.54. Lugs with indentation (Type B2) (depth: 0.50–4.23 m).

The nipples are often small, 2–3 cm in diameter, and are usually found on burnished pots. In some cases (depth: 1.75–1.85 m, *b*) they form part of applied plastic decoration. The buttons are effectively large round lugs, 3 to 6 cm in diameter (like those from a depth of 1.14–1.35 m), found on coarse and semi-coarse ware, and also combined with applied plastic decoration in some cases (depth: 1.20–1.30 m). Flat-topped buttons of various sizes have been found at different sites, such as Tharrounia (Sampson 1993, 114, drawing 115), Klenia (Phelps 2004, 113, 51.28), Kastria (Sampson 1997, 186–189, fig. 47, drawing 55 *passim*), and Kephala (Coleman 1977, pls 29M, 31P). The larger of these buttons, strongly projecting from the body of the vessel, are considered a later type (LN II), but appear very early in B1 (end of LN Ia, Figure 4.55, depth: 3.36–3.50 m), and continue to the beginning of LN IIB, but not into its late phase.

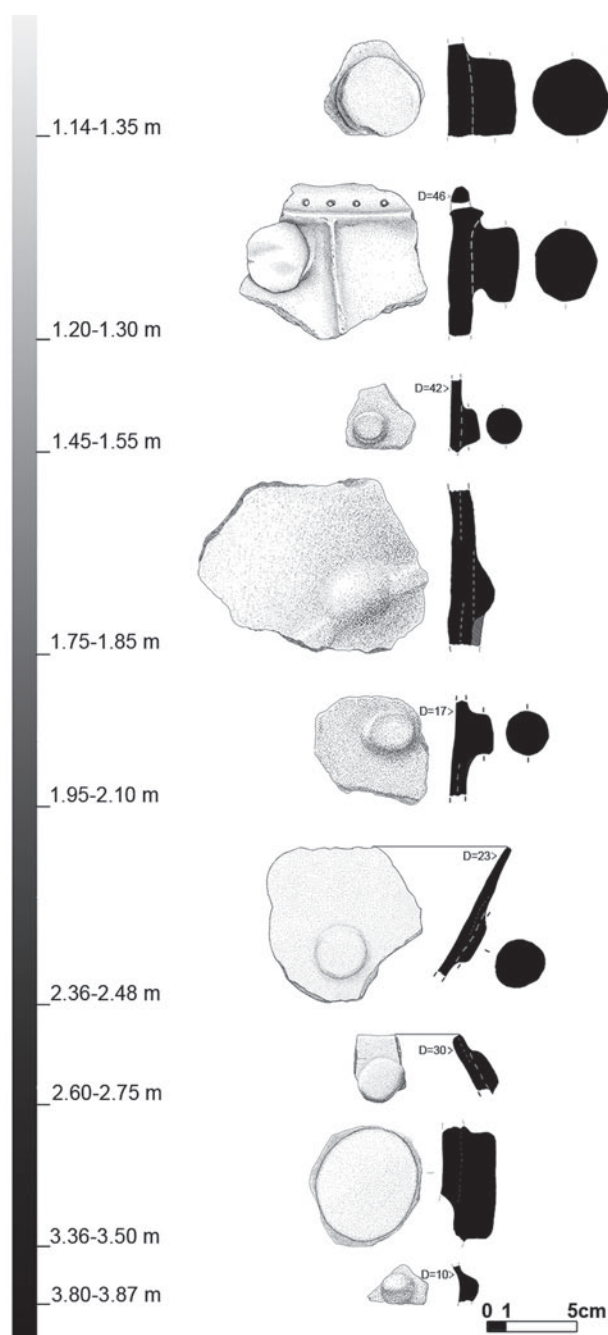


Figure 4.55. Circular lugs. (Type B3) Form development and find depth (1.14–3.87 m).

B4 (Figure 4.56)

The ‘elephant’ lug, one of the most characteristic features of the Final Neolithic, is effectively absent from B1. Only a single definite example was found in B1 (Figure 4.56), impressively faithful in its depiction of the trunk (cf. Vitelli 1999, 86, fig. 74e), although a few examples have a ‘suspicious’ tapering of their lower end.

Elephant lugs have been found at a large number of Neolithic sites and are considered a chronological marker of LN II. It has been argued, however, that they could be placed earlier (end of LN Ib), since their wart is

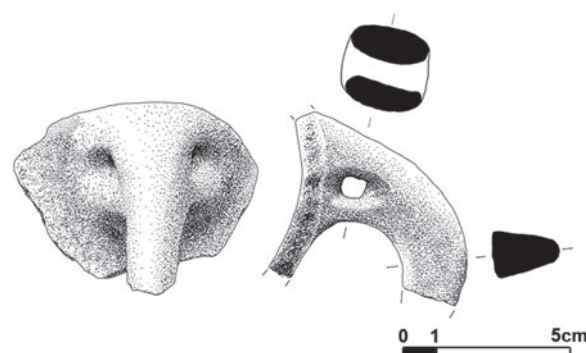


Figure 4.56. Elephant lug (depth: 2.60–2.75 m).

an LN Ib feature. Its absence from other Peloponnesian sites (e.g., Yerogalero and Ayios Dhimitrios, Zachos 2008, 39) has been interpreted, in the first case, as indicating that this lug may not be a very early feature of LN II in the Peloponnese and, in the second case, as hinting that this may be a local production that did not extend to all the sites in this area. The find layer of the elephant lug from B1 bears out the hypothesis of an early appearance of these lugs (c. 4,800 cal BC), although it must be stressed that the lug itself differs from the canonical type.

‘Cheese pots’

Thirty sherds come from peculiar vessels conventionally termed ‘cheese pots’, whose enigmatic function has long preoccupied scholars. These vessels diverge greatly from the common typology: they are low and shallow with an asymmetrical body and perforations at the rim. Their production centre is thought to be the Aegean, where they have been found in vast quantities, for example at Partheni on Leros, where 50% of the pottery consists of cheese pots (Sampson 1988, 100 and 2003, 89).

The precise typology of these vessels is undecided: their variety, the scarcity of whole examples, and their asymmetry all make a definitive comprehension complicated. They appear to follow a basic format, but a wide range is observable at sites where a large number have been found (as in the Dodecanese), indicating intensive but perhaps also, with time, varied use. This range might also, however, be interpreted as indifference to typological details, since all the variants serve the basic use, as yet unknown.

Overall, ‘cheese pots’ have a thick, rough base and low sides. Their special feature is the peculiar surface treatment, reversing the usual pattern in everyday pots: the inner surface is polished and the outer surface left rough; or at least the inside is always better finished than the outside. The interpretation of the vessels is not made any easier by oddities like the densely-placed perforations around the rim and the presence, only on the interior, of lugs or, more rarely, handles rising from the rim. External handles are never reported.

The examples from B1 (Figure 4.57) broadly follow this typology, while also presenting local features. The fabric is relatively evenly fired, solid (fragile in one case only), fracturing in a high relief.

The bases are rough and 1.0–1.7 cm thick. All bear clear imprints on the outside of organic materials/grass. A peculiar construction technique is observed in some: the base is built up of thick strips of clay, interwoven or simply attached to each other, rather than a single mass of clay, so that they make a high relief for the resting surface (depth: 0.94–1.02 m, 1.55–1.65 m, *a*). In some examples there is a sharply projecting edge where the body meets the base (Gr30/D2268, depth: 1.35–1.45 m). This proves that a mould was not used (at least not in these cases) to form the vessel during its construction, as has been argued for parallels at other sites; if that had been the case, this sharp edge would have been eliminated. It looks more as if it results from the attachment of two separate pieces. The edge thus formed increased the stability of the pot.

The walls are thick (0.9–1.8 cm). Their exact height is unknown, but in two cases where the full side-profile is preserved (depth: 1.35–1.45 m, 1.45–1.55 m, *a*) the vessels are 9.5 cm high. The inclination of the walls varies (vertical, inwards or outwards), but due to the asymmetry of the rim and the unevenness of the base, the precise angle is often uncertain. In the most fully preserved specimens, the sides slope strongly outwards to the rim (depth: 1.35–1.45 m). The surfaces are reddish-orange to dark brown (10YR 4/3, 4/4–5YR 5/4) and in most cases the outer surface is partially or well polished (slightly less than the interior). None has particularly coarse or very rough surfaces. Most examples, however, bear organic imprint traces in the clay or reveal the attachment of another layer of clay and fingerprints (depth: 1.30–1.35 m). Although their construction technique is unknown, these vessels from Diros are also worked on the outside, even with grass, as in examples from Ftelia (Doukaki 2009, 86, fig. 4.15) while the clay is still soft (depth: 1.35–1.45 m). The inner surface is very highly polished and occasionally roughly burnished. No traces of fire were observed on any of the sherds.

The holes at the rim, 2–3 mm in diameter, were pierced before firing, from the inside, and usually positioned 1–3 cm below the rim. There are no examples in B1 with perforations set very low on the body, but such, though rarely found elsewhere (Sampson 2002, fig. 56.357), were discovered in other parts of the cave (Locus B6). The perforations were carelessly made, resulting in asymmetrical holes of uneven height and shape with rough edges, sometimes failing to pierce the clay. The holes are circular in cross-section. Three examples have lugs inside the vessel, 4 cm below the rim. One lug has three vertical holes (depth: 0.82–0.94 m).

Some, at least, of these vessels must have had a sort of ‘opening’ on one narrow side, as can be seen from three examples where the rim drops strongly (*e.g.*, depth:

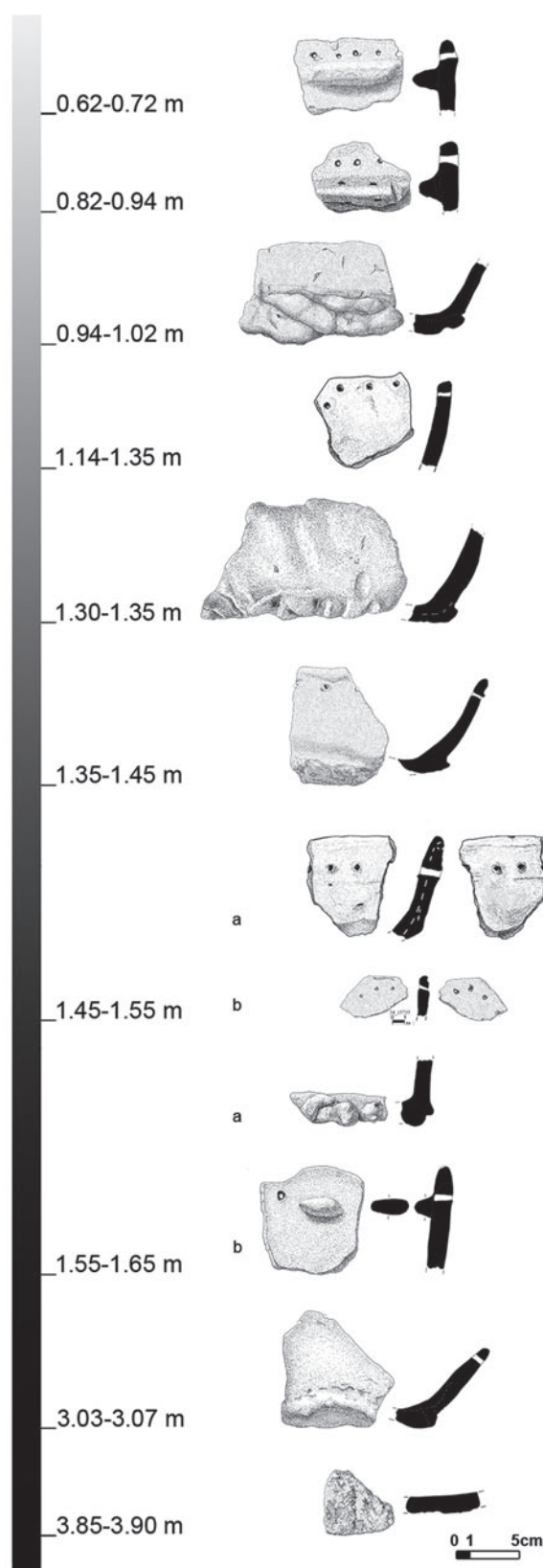


Figure 4.57. ‘Cheese pots’. Form development and find depth (0.62–3.90 m).

1.14–1.35 m, 1.45–1.55 m, *b*), a feature shared by cheese pots from other sites (Spitaels 1982, 1.15:47; Sampson 2002, fig. 58.373, and 2008, fig. 103.726, pl. 47). At Diros, the presence of this feature is confirmed by very good examples found in other parts of the cave (*e.g.*, Ossuary II).

Of the various interpretations of the construction technique and, above all, the use of these vessels, the most convincing are those based on the study of large groups. Thus it has been argued that these vessels were made on a wickerwork lattice attached to the holes (Sampson 1993, 166, and 2002, 63), and that the holes were also used to attach a mesh or net to the upper part or the exterior during use (Sampson 1988, 100; 1993, 166; and 2003, 100), or even to let a liquid overflow. However, examples exist, including some at the Alepotrypa Cave (B2), where the holes continue round onto the base of the pot; in these cases, the interpretation has to be more complex. As regards their function, they are thought to have been involved somehow in fishing, since large numbers have been found in coastal settlements, although the analysis of samples from such sites did not identify bromine (Sampson 2002, 64). Interpretations associated with baking or cheese-making are not confirmed. It would seem, then, that their interpretation will remain elusive for some time to come.

As for the ‘cheese pots’ from B1, not enough evidence remains to reconstruct their find context and so perhaps come to any conclusions regarding their use. All we can say is that their find context is mixed: 72% of the pots were found almost exclusively with storage vessels, and to a lesser extent with closed storage or cooking vessels, but the rest were found in the Burial layer, including the oldest example, from Burial B. The remainder (27%) come from Burial A, found together with abundant coarse ware and also fine pottery such as Ripple Ware, Incised and late Matt Painted pots. Unfortunately, given the mixing of these layers and the incomplete excavation data, the matter cannot be taken further.

According to information provided by local inhabitants, ‘cheese pots’ remind them of implements formerly used in food preparation. A mesh was attached to the rims, while struts (small twigs or rods) were placed or tied on to the interior lugs, transversely to the vessel, to support the mesh against the pressure of the liquid during pouring. Where the vessel had an open side, the strained liquid was poured out through the opening, which was then stopped up to prevent the rest of the contents escaping.

Very few published examples of ‘cheese pots’ are recorded from the Peloponnese, and archaeological finds are very limited (Sampson 1997, 123; Doukaki 2009, 38). Most belong to EBA and tend to follow the common typology of baking pans, as at Eutresis (Goldman 1931, 106–109, figs 141–143), Zygouries (Blegen 1928, 117), Korakou (Blegen 1921, 14), and Ayios Dhimitrios (Zachos 2008, 71–73). The sherds from Asea (Holmberg 1944,

55–56, figs 57a, c, 62d) stand out because they come from a Neolithic layer (but with mixed material), and resemble baking pans. Moreover, sherds reported from the Klenia Cave, although we do not know their precise type and excavation context, also seem to belong to EH I (Phelps 2004, 115). Finally, only one definite and two possible cheese pots sherds are reported from Kastria (Sampson 1997, 122–123, fig. 34). They are dated to the transition to LN IIa but should perhaps be placed at the end of this period, as it is mentioned elsewhere that they were found in the ‘upper Neolithic layers – almost in contact with the EH ones’ (Sampson 1997, 324).

Baking pans have been considered a second type of ‘cheese pot’ (Coleman 1977, 18), but their divergences from Aegean ‘cheese pots’ are significant: most lack holes, have traces of fire and present different surface treatment (they do not exhibit the reverse processing of the inner and outer surfaces). Detailed descriptions and illustrations/photographs are unavailable for much of the material.

The sherds from the Alepotrypa Cave do not resemble the Peloponnesian examples mentioned above, but rather the Aegean variants. They come from a Neolithic context, bear indications of local production (Pentedeka, this volume, Fabric Group 7) and, above all, are found in large numbers, with at least 190 sherds estimated to come from the cave. These are aspects that alter the received knowledge of the production and dissemination date of this type.

Dating

Generally, ‘cheese pots’ were considered a dominant vessel of LN II, covering the whole of the period from its beginning, LN IIa (classified among the early shapes of Period IV, Phelps 2004, 115) and extending to LN IIb (Sampson 1993, 185). This seems certain for the Peloponnesian examples, at least. The Aegean examples, however, combined with recent excavations and studies of this vessel type, have shown that some specimens emerge earlier and that these vessels may first appear at the beginning of the 5th millennium (Sampson 2002, 65, 2008, 188; Doukaki 2009, 25, 26), peaking in LN IIb (Sampson 2002, 65).

The cheese pot finds in B1 provide new information on the Peloponnese data since, although most are dated to LN II like the majority of these vessels, the three earliest examples appear much earlier, in LN Ia. Then the shape ‘disappears’ (at least no diagnostic sherds are known), to reappear in numbers throughout LN IIb, even into its late phase (at depths of 0.20 to 1.45 m).

The possibility that the sherds in the deepest layers may be intrusive cannot be excluded, especially for the earliest example, which comes from the layer of Burial B. However, both the next closest in date come from two successive layers of the late LN Ia/early LN Ib according to the radiocarbon dates (4,990–4,780 and 4,830–4,690 cal BC (OxA-29275 and 26357: Table 2.1)); no indications

exist as to whether the findspot was disturbed. The petrographic analysis of one of the two sherds (depth: 3.03–3.07 m) brings them forward chronologically, placing the sherd in question in the LN II pottery group of fabrics (Penteteka, this volume). However, the fact that other sites – although only Aegean ones – have also produced early examples makes their early appearance at Diros possible. If this is the case, our information on the first appearance of this vessel is overturned, since cheese pots are thought to have been introduced gradually to Mainland Greece from their centre, the East Aegean, under insular influence (Sampson 1997, 123), which would entail a chronological delay in examples from southern Greece. On the contrary, however, all three examples from Diros mark their first appearance in both areas.

In summary, the completion of the detailed study of all the cheese pots from the cave and their comparison with the B1 data is expected to shed further light on this peculiar vessel. Even if the new information cannot clarify the inception of their production and their use, it definitely alters our knowledge of the ‘cheese pots’ of the Peloponnese, extending the range of their discovery and production into southern Mainland Greece for the first time.

Rolled-rim bowls

Trench B1 produced at least 13 sherds from bowls with rolled rims (Figure 4.58). These are deep bowls, with straight or slightly curved walls of even thickness. The rim diameter ranges from 18 to 35 cm and the wall thickness from 6 cm to 9 cm. The surfaces are highly burnished or very carefully polished, varying in colour from brown (10YR 6/4) and orange-red (5YR 5/6), to grey-brown (10YR 5/2). The clay fabric is quite evenly fired, with medium-sized inclusions and has a soft to medium hardness (Mohs 2–3).

The edge of the rim is compressed; it is not always clear whether it is rolled over, as the name suggests, or whether it was formed by exerting pressure around the inside of the rim (Vitelli 2007, 124). However, in a few samples with relatively clear sections, an extra layer of clay is clearly to be distinguished on the interior of the rim, so forming the characteristic protrusion. Some samples have a hooked rim, a variant on the typical rolled rim and with parallels also at other sites (Phelps 2004, 118, 56.10).

Two examples have small vertical lug handles in which is a small hole. In one case, the lug is placed high up, with one end attached to the rim. Horizontal lug handles, pierced or not, are not uncommon on rolled-rim bowls; they are usually tubular or tunnel handle lugs, or even smaller examples, placed at rim height or lower (see collected typical examples from Kum Tepe IB and Emporio VII–VI).

Find depth/Dating

Bowls with rolled rims are among the commonest vessels of the FN–EH I period, with an impressive range

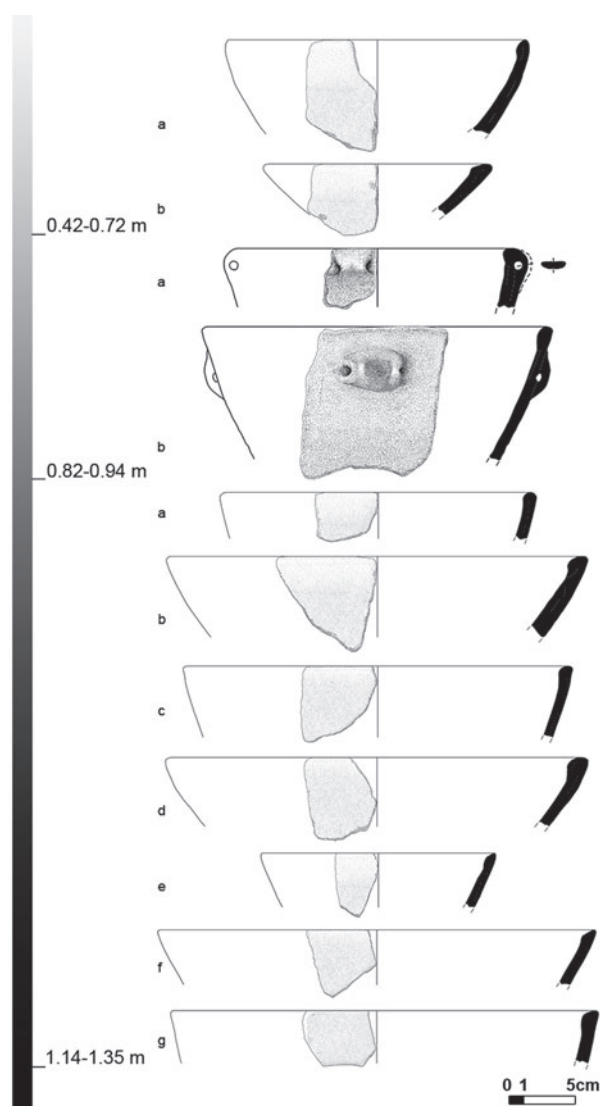


Figure 4.58. Rolled-rim bowls. Evolution and find depth (0.42–1.35 m).

extending from northwest Anatolia to the Aegean islands, and from Bulgaria to the southern Peloponnese. An understanding of the origin of the type, which is directly associated with its dating, depends on finds from sites with stratified data and associated pottery. The samples from B1, though few in number and derived from find contexts with incomplete excavation data (see below), still make a contribution to the study of the type in the Peloponnese, because they come from a stratified and dated site. This is particularly welcome since half of the ten or more locales in the Peloponnese that have produced rolled-rim bowls lack stratigraphy (Zachos 2008, 38). This is the case with the rolled rims of Klenia (Phelps 2004, 118) and the material collected in surface surveys at four sites (Chotousa-Agios Georgios, Levidi-Ai Lias, Milia-Agios Nikolaos and Davia-Kastro), probably to be dated to the EBA (Howell 1970, 107, pls 27a no. 2, 30a no. 1, 35a no. 1).

The known and dated examples cover the period from the end of LN II (Final Neolithic) to EH I. More specifically, the Corinth rolled-rim bowl belongs to a chronological horizon similar to the Agora phase and the Eutresis-Korakou phases (Phelps 2004, 118, fig. 56.15; Diamant 1974, 84, fig. 3.102); the rolled rims from Koufiero Cave, more similar to the Attic and Peloponnesian parallels, correspond to French's North Slope Phase and Eutresis Group II (Zachos 2008, 38–39, fig. 34.1–4); the rolled rim from Ayios Dhimitrios, although from a site dated to the early LN II phase, betrays, according to the excavator, the 'succeeding developments' of that phase (Zachos 2008, 39); while the rolled rims on Heavy Burnished ware at Lerna must date from near the middle of FN (Vitelli 2007, 124–126, fig. 83). Finally, at Eutresis rolled rims were found in Groups II and III (Caskey and Caskey 1960, 132–142), but the discussion of their stratigraphical sequence (Treuil 1983, 63–66; Zachos 2008, 38) indicates that the securely stratified rolled rims are those of Group III, which are thought to belong to the early stage of the EH I period.

The pottery associations and absolute dates of the layers containing rolled rims in B1 provide clear evidence matching the dating of the above sites. They were found at depths between 0.20 m and 1.35 m. Firstly, the associated pottery attests a LN II context, since it includes pithoi with plastic and rope decoration, 'cheese pots', bases with straw impressions, large quantities of monochrome burnished ware, and a plethora of coarse ware. Secondly, three samples from the find layers provide corresponding dates: 3,970–3,800 cal BC (0.82 m), 4,039 cal BC (0.51 m) and 3,370–3,100 cal BC (0.15 m) (see Table 2.1), placing the samples in LN II if they are in fact derived from the sloping layers L2–L3 (Figure 4.4). It is noted, finally, that the same chronology (LN II) applies to the 'North Sector' close by to Trench B1, which produced a large number of rolled-rim bowls (Rammou 2009, 81, 85, 105, 121ff.). In conclusion, it appears that the rolled-rim bowls of B1 fit well in the chronological data of the LN II stratified sites mentioned above, with a lifespan extending from the end of LN IIa throughout LN IIb.

Quantitative, stratigraphic and chronological sequence of pottery in B1

Any comprehension of the use of the B1 area and the regularity or otherwise of the sequence of layers and pottery mainly depends on four sets of data: the excavation practice, the excavation documentation, the pottery study and, finally, the interpretation of the absolute dating of the stratigraphy. The first two sets are unreliable in the case of B1, as detailed above (see above, 'Stratigraphic Sequence'), and the information they provide has been used on a case-by-case basis as a supplement to the latter two sets. This pair, the pottery study and the sequence of absolute dating and layers expressed in Stratigraphy II,

together form the main basis of evaluation, on their own or with a variable degree of dependence on the other two data sets.

During the study of the material and the available information, we have attempted to create a preliminary chronological framework against which to check the possible synchronisation of pottery categories, absolute dates, and traditionally accepted chronological patterns. This has proven a particularly hazardous endeavour due to the various problems known to be involved in the chronological patterns. These problems are exacerbated in the case of B1, since the complexity of the manner of excavation and 40 cm discrepancy (see above, 'Stratigraphic Sequence') mean that although the dating samples are found at precise depths, yet the pottery assemblages are at different ones. However, the reconstruction attempted was judged necessary in order to create an initial basic model of development (even with discrepancies) within which one might discuss the limitations of the application of the old patterns to the more 'measurable' data (the absolute dating).

The pottery data from B1 are occasionally inconsistent with the results of the absolute dating samples: sometimes they match the general chronological structure or the general pottery category framework, and sometimes not. It appears that one of the basic reasons for this discrepancy is the excavation practice and the morphology of the B1 site (the two-fold sloping of the layers). More specifically, the charcoal samples date the archaeological layers. These layers are, however, inclined, whereas the excavation was carried out horizontally. Thus a horizontal excavation spit, for instance at a depth of 2 m, cuts through three different layers (see Figure 4.4). This means that, not knowing the precise findspot of these sherds, at least in the strongly sloping strata, we cannot tell which of the three layers they come from. This difficulty is compounded by the discrepancy of the lost 40 cm, meaning that the sherds may be 'moved' 40 cm higher or lower (see section 'Stratigraphic Sequence'). (Note that this does not affect the material from 4.0 m and lower, as those depths have been corrected). However, during the study of the material it was observed that even if we incorporate these issues (*i.e.*, if we move the samples by 40 cm and place them in three different layers), the discrepancies in B1 persist. This is because the layers immediately following in each case do not permit a large chronological 'correction' of the pottery samples, since they set a new limit with new, 'high' or early dates (a typical case being that of stratigraphic unit *b*; see below).

It seems that, for now, the argument that the considerable disturbance and movement of material from pits, surface coatings, structures and fills that has been put forward, coupled with the intense and varied activity known to exist in cave environments generally, may provide a more convincing – albeit partial – explanation for the observed discrepancy.

Regarding the major subject of the dating and acceptance of a unified chronological framework, the complexity of the issue is well known: it has actually been increased rather than reduced by the new excavations. The exceptional good fortune of having 14 samples for dating, and the long sequence of LN pottery in B1, have led to the adoption, at least in a conventional framework, of a scheme with sub-phases for the Late Neolithic (Sampson 1993, 283–287 and 1997, 322). According to this, the traditional LN I period (5,300–4,300 cal BC) is subdivided into LN Ia (5,300–4,800 cal BC) and LN Ib (4,800–4,300 cal BC), while the Final Neolithic period (4,300–3,200/3,000 cal BC) is subdivided into LN IIa (4,300–3,800 cal BC) and LN IIb (3,800–3,200/3,000 cal BC). Nevertheless, it is to be noted that this pattern is used conventionally for the time being, due to the existence of other radiocarbon dates which assist in delineating the divergence from or convergence with the accepted chronological patterns or cultural phases (see also Papathanasiou, Chapter 2 this volume, and Karkanas, this volume).

Reference to either the four-part division of the Neolithic according to Phelps (periods I–IV) with further subdivision into early and late phases or to three phases (Phelps 2004, 7), an equally basic and documented system of chronological classification, is used on a case-by-case basis and in comparison to the first system.

A: a. EN/MN

L15 (4–4.80 m) is the oldest layer of B1 excavated to date. The charcoal samples date it to c. 6,000–5,400 cal BC, corresponding, according to the generally accepted dating, to the period from the end of the EN to the end of the MN. The main structures of this layer are pit-like formations, a large stone Hearth and Burial C. The pottery of L15 is as follows:

At a depth of 4.60–4.80 m (layer of Burial C), 96% of the pottery consists of coarse, semi-coarse, and monochrome, mostly rough-burnished sherds. The remaining 4% is taken up by an extremely interesting category, that of Urfirnis (Monochrome and Scribble), hitherto thought to be almost absent from the cave with only a few exceptions (Psimogiannou, this volume). The new pottery data from B1 confirm the presence of Urfirnis (Table 4.1), even increasing somewhat with time. Thus, at a depth of 4.25–4.60 m it forms at least 13% of the total pottery, with a striking concentration at 4.25–4.40 m, the location of the stone Hearth with its unique contents. Urfirnis continues up to the uppermost level of L15 and, decreasing, even into L14 (Burial B, 5,480–5,320 cal BC (OxA-22013; 6,415 ± 35 BP)). However, after a short break, a few sherds appear in LN I layers, though one should bear in mind the difficulty in identifying them. The Urfirnis material of the cave has proven particularly difficult to identify due to the very small size and poor preservation of the sherds, but mostly belongs to the MN period (K. Vitelli pers. comm.), which closely matches the absolute dates

of part of L15. Earlier (EN) samples cannot be confirmed from the material currently available, meaning that up to 4.30 m the pottery closely matches the absolute dating of the layer with regard to the Middle Neolithic.

In the upper part of L15, the radiocarbon samples date the depositions to the end of the MN (5,480–5,320 cal BC and 5,480–5,330 cal BC; OxA-26358 and 29168; see Table 2.1). There the fine ware consists of Urfirnis, a few Black Burnished sherds, and very few probably Matt Painted, which have given rise to the questions of their first presence. Any understanding must take into account the many pit-like structures in the layer which disturb the area and jumble materials, especially in the case of the extensive Hearth on Burial C (Sq. A, about 4.40 m), but also in the lowest part of Burial B.

All in all, the pottery material of L15 is in a very damaged state, with most of it (75%) just tiny sherds (1–3 cm) with very worn surfaces. This indicates either the lengthy exposure of these layers and a very slow rate of soil coverage, or exposure of the pottery elsewhere, inside or outside the cave, prior to its redeposition in B1. The quantity of pottery is very limited at first (71 sherds, depth: 4.60–4.80 m). However, although it increases in quantity in the layers immediately following (520 sherds, depth: 4.30–4.45 m), the picture of the material continues to present an internal homogeneity, mostly consisting of small worn, fragmentary sherds, especially compared to those from the layers directly above. The few, worn sherds of the lower layers may indicate that the area saw limited human presence and/or experienced long periods of disuse, a hypothesis strengthened by the observation that remains of burning deposited anthropogenically in this layer were scattered throughout the area by natural processes (Karkanas, this volume). In any case, what is certain is that the picture of the pottery changes quite significantly above 4.20 m (a point at which we have a dating sample of 5,415 cal BC).

In summary, it appears that: a) the lower level of B1 (part of EN and MN) seems relatively ‘sealed’, as no clear mixing of material with later material has been observed so far (although this may be due to the limited area of the excavation); b) the MN layers of B1 are quite small, while the areas have been exposed at various times (*cf.* also the sherds coated in a thick layer of travertine, Gr827); c) towards the end of the MN period, later elements, not expected in MN, appear in B1; d) the transition to LN I occurs around 4.0 m, where Urfirnis comes to an end and Black Burnished ware makes a dynamic appearance.

A: b. MN

The area of Burial B is dated to the end of the MN period (if we accept the date of 5,800–5,300 cal BC for MN), with two excellent identical samples at c. 5,480–5,330 cal BC and 5,480–5,320 cal BC; OxA-22013 and 22012 respectively; see Table 2.1). The depth of the pottery from this area cannot be defined with the same

precision due to the discrepancy of the 'lost' 40 cm (see above, 'Stratigraphic Sequence'). However, if we restrict ourselves to the lowest level of the burial (*i.e.*, around 4.0 m, according to the depth provided by the excavation measurements), we approach the unit where the samples are taken from. There the fine ware consists of 9% Urfinis, 48% Black Burnished, 23% Black/Grey Burnished, 6% Grey Burnished, 7% Matt Painted (perhaps less due to identification issues, see relevant section), and 7% other fine and semi fine unidentified wares. The chronological appearance of some elements of this assemblage slightly matches the absolute dates, as in the case of Black Burnished ware (late MN) or Black Burnished with white painted decoration (early LN I). We cannot, however, exclude the possibility that they may have appeared before c. 5,400 cal BC, given that certain Black Burnished samples of that date present developed vessel shapes, advanced surface treatment and high production rates. On the other hand, the Grey Burnished and, especially, Matt Painted categories are apparent strikingly early, almost irreconcilably so, and simultaneously. It should be noted that their findspot (Burial B) has been disturbed not just once but repeatedly, as the area was reopened for new burials. This disturbance is also confirmed by the fact that in areas with identical radiocarbon dates (end of L15 and beginning of L14), the proportions of wares are very different (see above EN/MN). To summarise, the assignment of the Burial B layer in absolute dating terms to the end of the MN period is difficult to reconcile with the pottery data, and can only be accepted if the area was strongly disturbed.

B: LN I

According to the absolute dates, the LN I fill spans a depth between approximately 1.30/1.70 to c. 3.80/4.0 m, corresponding to layers L4–L14a. In order to study these deposits, this span is divided into three stratigraphic units, rather arbitrarily as they overlap at the edges: unit *a*, extending from the centre of L9 to L14a, with no radiocarbon dates; unit *b* extending from L7 to the middle of L9, dated c. 4,800 BC; and unit *c*, layers L4, L5 and L6 (?), dated towards the end of LN I (4,550–4,370 cal BC and 4,550–4,370 cal BC: OxA-26356 and 29077; see Table 2.1).

Unit a

This unit has no absolute dates because the samples taken did not provide any. All we can say is that we do not have absolute dates falling within LN Ia, but this whole unit lies between two temporal milestones, 4,990–4,780 cal BC (L9) and 5,480–5,320 cal BC (L14) (OxA-29275 and 26358; see Table 2.1), and could therefore cover LN Ia or part of it, if there are hiatuses involved in the record. The pottery, however, covers this gap in the dates with the presence of features placed in LN Ia. The unit mainly consists of two thick stony layers (L11, and part of L14a)

created by a collapse episode which may have been an old event or a gradual one, but the unit was subject to several filling and levelling of occupational episodes (Karkanis, this volume). The filling and levelling hypothesis was confirmed through excavation by the detection of the surface coatings (such as the 'tamped floor' at 2.80 m or the 'paved floor' at 3.05 m), the distinctive structures (Fire I at 2.95 m, 'circular structures' at 2.80 m and 3.09 m) and the Hearths (Hearth I at 3.18–3.23 m and Hearth II from 3.23 m onwards) (see above, 'Stratigraphic Sequence'), although we do not know the degree and extent of any possible hiatuses due to the collapses.

The quantity of pottery recovered differs from that of the underlying layers, increasing strongly in the stony layers (throughout L9 and part of L11 and L14a). For example, a single layer just 5 cm thick (at 3.18–3.23 m) produced the largest amount of pottery found in B1 (1,709 sherds). An equally massive concentration of pottery is found in two further excavation layers, at a depth of 3.24–3.45 m and 3.40–3.60 m, which produced 1,338 and 709 sherds respectively. It is interesting to note that this increase is not observed across the whole trench but is localised, which may indicate the possible existence of hiatuses in this unit. More specifically, the increase is mainly seen in the west half of the trench (Sq. Γ-Θ), in the area of Hearth II. Thus, for instance, the west side produces 425 sherds (3.32–3.46 m – Sq. Γ), but the eastern Square M only gives 29 sherds at the same depth (3.35–3.47 m). Consequently, in spite of the collapse events that occurred in the unit, creating the stony layers, people seem to have returned often and carried out intensive activities, as the pottery evidence shows. If there are any hiatuses, they must be sought more in the east part of B1, in quite physically restricted spots.

The pottery from unit *a* has proven to be particularly important, because there are no absolute dates for this unit. There is a significant amount of Black Burnished ware, a small increase in Grey Burnished, which still remains low compared to the other two categories, and a great explosion of coarse wares, all elements that can easily be placed in LN Ia. An LN Ia date is also confirmed by reliable data based on the ceramics such as the presence of rhyta (3.50–3.88 m), typically a mark of the early phase of LN Ia, or sherds with incised and punctated decoration, which are about at the end of LN Ia and one of them was found at 3.20 m, dated to c. 4,800 cal BC. However, some pot material is inconsistent with such a temporal position, such as sherds of Polychrome ware that appear low down, in an LN Ia context (3.45–3.60 m), 'cheese pot' sherds at depths of 3.55 and 3.90 m, or sherds with rope decoration (3.50 m), all better placed in the following period. Yet this inconsistency, too, is resolvable, if one bears in mind that the stony layers were subject to repeated phases of coating with travertine and disturbance due to constant filling and levelling practices. Also, the big clay-lined pit in L14, which, opening in a higher layer (L10), would necessarily

have mixed materials from different periods. Generally speaking, most of the pottery from unit *a* presents a good, sensibly developing sequence, as in the case of Black Burnished, whose numbers fall as we progress towards the higher levels (3.20 m). What is most difficult to discern is whether cases of individual rogue elements are due to the mixing of material in this layer, for instance certain Black Burnished rim shapes (see above, Black Burnished), or whether these are simply early examples of their class (as with the rope decoration sherds of B1, see above).

Unit *b*

The unit consisting of the thick deposits between approximately 1.70/2.0–2.60/3.00 m is particularly problematic. It has provided three statistically identical dates (4,950–4,740 cal BC, 4,830–4,690 cal BC and 4,990–4,780 cal BC; Oxa-26378, 26357 and 29275; see Table 2.1) corresponding to LN I, specifically the cusp between LN Ia and LN Ib (if we accept a date of 4,800–4,300/4,200 cal BC for LN Ib). This unit includes layers L7 and L8, which contain both chaotic mixtures and undisturbed areas, and part of stony layer L9 with the characteristics described above (see above, unit *a*).

The quantitative development of the pottery in unit *b* matches the characteristics of L9 with consistently large quantities, but no more can be said on the matter for L8 and above due to the lack of appropriate excavation squares in the trench.

The ratios of the pottery categories change in unit *b*. They present a greater variety compared to the lower levels. At a depth of 2.70 m, Black Burnished has come to an end. The few sherds of this sort found above this depth are from strikingly different shapes with thick walls. Grey Burnished also declines very early on, its sherds appearing up to 2.48–2.60 m. Matt Painted is significantly reduced, falling from 607 sherds (3–4 m) to 240. The last Polychrome sherds, taking into account the difficulty of identifying them, appear at a depth of 2.36–2.48 m, with very few collected above this depth. At 3.00 m, we have the appearance of handles with a ledge lug, a type belonging more to the beginning of LN Ib and continuing to its end. The last sherds of ‘differentiated’ rhyta are found in the same context (2.25–2.36 m), together with sherds of ‘cheese pots’ and Rippled ware, storage vessels with plastic and rope decoration, impressed pots and, finally, a base with impressions.

The pottery data are ambiguous. Some aspects, as when Black and Grey Burnished wares come to an end, match the absolute dating of the unit very well. In other cases, however, such as with Rippled ware, the 4,990–4,780 cal BC (Oxa-29275; 5,982 ± 36 BP) date makes the Diros samples earlier than those of other sites. Even the handles with a ledge lug must be placed before c. 4,800 cal BC (or even just at the end of LN Ia), although they are expected to start in the following period (see above). In unit *b*, the ‘cheese pots’, predominantly a type of the following

phase, will be among the earliest documented examples of this category (see above). The same seems to be true of the examples of storage wares with rope and plastic decoration; although early samples are reported, they are generally considered to be one of the LN II ceramic categories. Moreover, the impressed pots, although most belong to the early part of LN II – the generally accepted date for this category (Bonga 2013, 271 – are also found in this layer (c. 4,800 cal BC), following the earliest samples once again (Sampson 1993, 154). Finally, and even more problematic, is a sherd with mat/straw impressions, which one would expect to find in later periods (late LN II, Phelps 2004, 120).

In summary, in unit *b* the radiocarbon samples provide a consistent date of c. 4,800 cal BC, but the pottery also gives possibilities for a later dating. This may be interpreted in one of two ways: either a) we accept the date of c. 4,800 cal BC and therefore the fact that some samples from Diros provide evidence of an early starting date for categories traditionally placed later, for the most part; or b) we must accept the fact that these layers include deposits dated after c. 4,800 cal BC (at least to LN Ib), even though the three dating samples are somehow all derived from layers of the same time frame (c. 4,800 cal BC). The second case is theoretically possible, as far as disturbances having occurred is concerned, as is proven by the excavation (see above, ‘Stratigraphic Sequence’). But it seems very strange, if not actually outright impossible, that the three samples taken from non-continuous areas happened to be from ones that were all disturbed and all of the same chronological composition. Even if we believe this, the samples cannot be moved to any later than LN Ib, since the layers immediately above (L4, L5) do not provide a date after 4,550–4,370 cal BC (Oxa-29077, and 26356; see Table 2.1).

Unit *c*

Unit *c* (L4 and L5, L6?) covers the depth between 1.30/1.50–2.0 m and is placed at the end of LN I (LN Ib) by two radiocarbon samples (4,550–4,370 cal BC; Oxa-29077 and 26356, see Table 2.1). The amount of pottery in this unit remains particularly high (around 4,350 sherds), indicating particularly intense activity in the unit (see also Karkanas, this volume), the main feature now being the cessation of the painted categories and the strong presence of coarse wares (Table 4.3; CPI 27). This unit is characterised by two definite elements of ‘disturbance’, at least for L4, which must be at least partly responsible for certain ceramic discrepancies here: the clay-lined pit (bothros) and Burial A, which is particularly extensive, as the most recent research data indicate (see above, ‘Stratigraphic Sequence’).

The fine ware categories common to Trench B1 (Black Burnished, Black-Grey, Black-Grey Burnished, Matt Painted, Polychrome) have come to an end, while the few examples of certain types (such as a score or so Matt

Painted sherds) are negligible. Their presence may be interpreted in many different ways. As for the rest of the pottery categories, they are represented by a few pieces of impressed and incised ware, and most of the Rippled ware. All of these are placed by absolute dating – with the possibility of chronological precocity – in LN Ib. The most pressing questions are raised by the pithoid sherds with plastic decoration, as their most intensive production is thought to date to the following period (LN II), although a few samples are recorded in LN Ib. They cannot be explained as being intrusions into a LN Ib context due to later disturbance of the unit, because, even if we limit ourselves to the samples collected up to a depth of 1.50 m, their number is still particularly high (105 samples). The possibility of an early sample date or disturbance to the unit must also be examined in the case of ‘cheese pots’; although examples are known in LN Ib, they are considered one of the most representative categories of the following period, LN II. It should anyway be noted that this unit offers a good internal correspondence between the component pottery types, independent of the dating samples, and appears to contain features that, according to the traditional view of ceramic correlations, may ‘shift’ it slightly towards the end of LN Ib, the end of Phelps’ Period III.

C: LN II

According to the absolute dates, the uppermost layers (L1–L3b/c) belong to the LN II period, with three samples taken from depths of 0.15 m (3,370–3,100 cal BC; OxA-29167), 0.51 m (4,039 cal BC) and 0.82 m (3,970–3,800 cal BC; OxA-26355); see Table 2.1. These radiocarbon dates indicate another ‘gap’, between this uppermost unit of B1 and the underlying unit, L4, a gap which seems to correspond to approximately 500 years (c. 4,500–4,000 cal BC, Karkanas, this volume). These layers feature a greater regularity of deposits, with domestic occupational deposits and levelled surfaces, containing local fires, hearths, and ‘undiagnosed’ stone structures, and an even more impressive regularity in the uppermost layer (L1), with undisturbed constructed clay surfaces, thanks to the fact that L1 was sealed and the area was never used again.

The main characteristics of the pottery are the almost total predominance of coarse ware and the strong presence within this of storage vessels. At the level probably corresponding to LN IIb (from the surface to a depth of 0.50 m), identifiable pithoid jars (with rope and plastic decoration) form almost 50% of the total. As for the pottery categories, these layers are in close conformity with the absolute dates, as they contain typical LN II wares including one of the most representative types of the period, rolled-rim bowls. There are also examples of very common LN II categories, such as ‘cheese pots’, and vessels with matt impressions. The two most representative categories of LN II, Pattern Burnished and Crusted wares,

have not been found in B1, except for one example of the former and one of the latter, which unfortunately cannot now be relocated. On a first reading it could be said that the absence of these categories, as well as of elephant lugs, which generally mark the beginning of LN II, confirm the radiocarbon dates that point to the absence of this period in B1. However, we must bear in mind the difficulty of identifying samples of Crusted ware due to the way its surface fails to retain pigment, and also the fact that it covers the whole of LN II in the Peloponnese and could thus well have been found in the immediately overlying layers of B1. We do in fact have a very few indications of its presence in the cave (Diamant 1974, 108; Mari 2004, 120; Psimogiannou, this volume). Moreover, in the layers from which the above wares are absent, B1 has produced bowls with rolled rims, a morphological feature that, although slightly later in date, coexists at some sites with Crusted ware, Pattern Burnished, and elephant lugs, or in combination (see rolled rim bowls with pattern burnished decoration, Lambert 1981, 286). What we can say more generally at this stage of research is that, according to the absolute dates, there is a gap in B1 corresponding to a transitional LN Ib/LN IIa phase, and it does indeed appear that some ceramic elements belonging to this period have not so far been found in the B1 material.

LN II involves relatively thin deposits in the trench (approximately 1 m). Even if we include part of the underlying layers, due to their steep inclination (see L4 south profile), their final depth still remains restricted (to around 1.30 m) compared to that of LN I, a pattern again indicating low intensity or sporadic occupation (Karkanas, this volume). The pottery-count data also confirm the ‘limited’ nature of the deposits, as there is a dramatic drop in the number of sherds (1,215) compared to the previous period (18,727). It should, however, be noted here that the diary records have been preserved for five excavation spits of these layers, and it seems that they produced a higher number of sherds than those in the storerooms today, almost double the material preserved. But even if we were to double the sherds for all the LN II excavation spits, the number would still remain particularly low compared to the previous period. It should be ascertained whether these indications of brief periods of use and/or occasional abandonment of the area during LN II, especially for a cave considered representative of the LN II period (Phelps 2004; Sampson 1997, 349 and 1993, 287), also affect other parts of the cave (Psimogiannou, this volume; Katsarou, this volume), and, if so, whether activities were moved elsewhere, such as to Ksagounaki immediately outside the cave (Pullen *et al.*, this volume).

To summarise this contribution, the following points are the most important: a) the radiocarbon dates from B1 delineate an extremely good sequence from 6,010–5,880 cal BC to 3,370–3,100 cal BC (with two exceptions; see Table 2.1). This cannot be ignored. There are two possibilities to account for this situation: either the levels

are indeed all correctly dated or the sampling points coincidentally provide a very logical temporal sequence; b) the vast majority of the ceramic evidence presents a regular and relatively cohesive picture of a series of good find contexts. However, discrepancies do exist at all periods and involve long passages of time, although they are relatively few in number. We must accept either that we have at Diros examples of vases that are early when compared with their generally accepted dates, or that all the discrepant examples occur because of disturbances, which – most amazingly – almost all the samples taken for dating happened to miss. As unlikely as this possibility may seem, we cannot rule it out (Karkanas, this volume for layers L7–L9); c) the intense activity inside the cave, the excavation practice, the chance sampling, the circumstantial nature of pottery groups in limited excavation areas, the lack of comparanda for many layers of B1, must all be factored into the wider issue of the sequences of the pottery; d) dates, pottery styles, cultural phases and their subdivisions have been faithfully adhered to by scholars for decades, without being subjected to sufficient systematic scrutiny and calibration. As a result, possible discrepancies have been unwittingly reproduced and introduced, as the pottery contexts of the new excavations are adapted to fit the old established patterns, rather than the opposite, which is more methodologically correct. Such a practice means that the mobility and mutability of people, societies, and artefacts, which cannot be ‘delimited’ within a strict framework, perpetually escape us, weakening dating systems and complicating interpretations. Thus, rather than adopting the hypothesis of the early appearance of pottery wares and types, it might be less risky to reframe the question of adaptation and reconsider the traditional dating scheme, at least based on the B1 data, and reconsider the relationship among absolute dating, pottery styles and cultural phases. This rephrasing of questions should take into account – however idealistic it may seem – as recent studies rightly have, the fluidity of human groups, who discard or ignore, vary or persist with certain types and styles of material culture.

Ultimately, the correlation of the ceramics with the chronological data from B1, although still under study, will form the basic points of reference and comparison for all of Alepotrypa Cave, since, in spite of the fragmentation of its contents compared to the exceptional material from other areas of the cave, Trench B1 preserves the unique privilege of providing an overall depiction of the cave’s longest attested period of use.

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Note

- 1 The author prefers the tripartite chronological system for the Neolithic advocated by Sampson (most recently, 2008) and others, although the chronological system of Renfrew (1972) and Phelps (2004) in which a fourth period, the Final Neolithic, spans the end of the Neolithic, is used by the other contributors to this volume. Thus the Late Neolithic II period of Sampson and as used in this chapter corresponds to the Final Neolithic period as used elsewhere in this volume. See Chapters 2 and 3, this volume, for radiocarbon dating and periodisation at Alepotrypa.

Bibliography

- Benać, A. (1973) Obre I. Neolitsko naselje starčevačko-impresso i kakanjske kulture na Raskršću. *Glasnik Zemaljskog muzeja Bosne i Hercegovine* 27/28, 5–102.
- Blegen, C. W. (1921) *Korakou. A Prehistoric Settlement near Corinth*. Boston, New York.
- Blegen, C. W. (1928) *Zygouries. A Prehistoric Settlement in the Valley of Cleonae*. Cambridge.
- Blegen, C. W. (1930) Gonia. *Metropolitan Museum Studies* 3, 55–80.
- Blegen, C. W., Caskey, J. L., Rawson, M. and Sperling, J. (1950) *Troy. General Introduction. I: The First and Second Settlements*. Princeton.
- Bonga, L. (2013) *Late Neolithic Pottery from Mainland Greece, ca. 5.300–4.300 B.C.* Unpublished PhD dissertation, Temple University.
- Bonga, L. (2014) Late Neolithic ‘Rhyta’ from Greece: context, circulation and meanings. *Rosetta* 15, 28–48.
- Caskey, J. L. and Caskey, E. G. (1960) The earliest settlements at Eutresis: supplementary excavations, 1958. *Hesperia* 29, 126–167.
- Chatziangelakis, L. (1984) Ο Προϊστορικός οικισμός της Πετρομαρούλας. *Ανθρωπολογικά* 5, 75–85.
- Christakis, K. S. (2005) *Cretan Bronze Age Pithoi, Traditions and Trends in the Production and Consumption of Storage Containers in Bronze Age Crete*. (Prehistory Monograph 18). Philadelphia.

- Coleman, J. E. (1977) *Keos 1. Kephala: A Late Neolithic Settlement and Cemetery*. Princeton.
- Diamant, S. R. (1974) *The Latter Village Farming Stage in Southern Greece*. Unpublished PhD dissertation, University of Pennsylvania.
- Doukaki, A. (2009), *Τα Ανοιχτά Αγγεία με Οπές στο Χείλος από τον Νεολιθικό Οικισμό της Φτελιάς, Μυκόνου*. Unpublished Master thesis, Aristotle University of Thessaloniki.
- Douzougli, A. (1998) *Άρια Αργολίδος: Χειροποίητη κεραμική της Νεότερης Νεολιθικής και της Χαλκολιθικής περιόδου*. (Archaiologikon Deltion Δημοσιεύματα 66). Athens.
- Dujmović, F. (1953) Neolitska obredna posuda iz Danila u Dalmaciji. *Vjesnik za arheologiju i historiju Dalmatinsku* 54, 73–75.
- Evans, J. D. and Renfrew, C. (1968) *Excavations at Saliagos near Antiparos*. (British School at Athens Supplement 5). London.
- French, D. H. (1964) Excavations at Can Hasan. Third Preliminary Report, 1963. *Anatolian Studies* 14, 125–137.
- Furness, A. (1956) Some early pottery of Samos, Kalimnos and Chios. *Proceedings of the Prehistoric Society* 22, 173–212.
- Giannopoulou, M. (2010) *Pithoi. Technology and History of Storage Vessels through the Ages*. (British Archaeological Reports S2140). Oxford.
- Gimbutas, M., Winn, S. and Shimabuku, D. (1989) *Achilleion: A Neolithic Settlement in Thessaly, Greece, 6400–5600 BC*. (Monumenta Archaeologica 14). Los Angeles.
- Goldman, H. D. (1931) *Excavations at Eutresis in Boeotia*. Cambridge.
- Hansen, H. D. (1937) The prehistoric pottery on the North Slope of the Acropolis, 1937. *Hesperia* 6, 539–570.
- Hauptmann, H. and Milojcic, V. (1969) *Die Funde der frühen Dimini-Zeit aus der Arapi-Magula Thessalien*. (Beiträge zur Ur- und Frühgeschichtlichen Archäologie des Mittelmeerkulturraumes 9). Bonn.
- Henrickson, E. F. and McDonald, M. M. A. (1983) Ceramic form and function: an ethnographic search and an archeological application. *American Anthropologist* ns 85, 630–643.
- Holmberg, E. J. (1944) *The Swedish Excavations at Asea in Arcadia*. Skrifter utgivna av Svenska Institutet i Rom 4^o, 11. Lund.
- Hood, S. (1981) *Excavations in Chios, 1938–1955: Prehistoric Emporio and Ayio Gala, I*. (British School at Athens Supplement 15). London.
- Hood, S. (1982) *Excavations in Chios, 1938–1955: Prehistoric Emporio and Ayio Gala, II*. (British School at Athens Supplement 16). London.
- Howell, R. (1970) A survey of Eastern Arcadia in prehistory. *Annual of the British School at Athens* 65, 79–127.
- Immerwhar, S. A. (1971) *The Athenian Agora XIII. The Neolithic and Bronze Ages*. Princeton.
- Johnson, M. (1999) Chronology of Greece and South East Europe in the Final Neolithic and Early Bronze Age. *Proceedings of the Prehistoric Society* 65, 319–336.
- Korošec, J. (1952) Nova neolitska kulturna grupa na području Dalmacije. *Vjesnik za arheologiju i historiju Dalmatinsku* 54, 91–116.
- Kotsakis, K. (1983) *Κεραμική Τεχνολογία και Κεραμική Διαφοροποίηση, Προβλήματα της Γραπτής Κεραμικής της Μέσης Νεολιθικής Εποχής του Σέσκλου*. Unpublished PhD thesis, Aristotle University of Thessaloniki.
- Kyriatzi, E. (2000) *Κεραμική τεχνολογία και παραγωγή. Η κεραμική της Ύστερης Εποχής του Χαλκού από την Τούμπα Θεσσαλονίκης*. Unpublished PhD thesis, Aristotle University of Thessaloniki.
- Lamb, W. (1936) *Excavations at Thermi in Lesbos*. Cambridge.
- Lambert, N. (1971) Grotte de Kitsos. *Bulletin de correspondance hellénique* 95, 703–735.
- Lambert, N. (1972) Grotte de Kitsos. *Bulletin de correspondance hellénique* 96, 817–844.
- Lambert, N. (1981) La céramique néolithique. In N. Lambert (ed.) *La grotte préhistorique de Kitsos (Attique), Missions 1968–1978: L'occupation néolithique. Les vestiges des temps paléolithiques, de l'antiquité et de l'histoire récente*, I, 275–347. Paris.
- Lavezzi, J. C. (1978) Prehistoric investigations at Corinth. *Hesperia* 47, 402–451.
- Lavezzi, J. C. (2003) Corinth before the Mycenaeans. In C. K. Williams II and N. Bookidis (eds) *Corinth: The Centenary: 1896–1996*, 63–74. (Corinth 20). Princeton.
- Mari, A. (2002) *Η Νεολιθική Εποχή στο Σαρανικό*. Unpublished PhD thesis, Aristotle University of Thessaloniki.
- Mills, B. J., (1989) Integrating functional analyses of vessels and sherds through models of ceramic assemblage formation. *World Archaeology* 21, 133–147.
- Papathanasiou, A. (2001) *A Bioarcheological Analysis of Neolithic Alepotrypa Cave, Greece*. (British Archaeological Reports S961). Oxford.
- Papathanasiou, A. (2009) Mortuary behavior in the Alepotrypa Cave: assessments from the study of the human osteological material. In W. G. Cavanagh, C. Gallou and M. Georgiadis, (eds) *Sparta and Laconia: From Prehistory to Pre-modern*, Proceedings of the Conference Held in Sparta, Organised by the British School at Athens, the University of Nottingham, the 5th Ephoreia of Prehistoric and Classical Antiquities and the 5th Ephoreia of Byzantine Antiquities, 17–20 March 2005, 21–28. (British School at Athens Studies 16). London.
- Papathanassopoulos, G. A. (1971) Σπήλαια Δυρού, Ανασκαφαί του 1970–1971, *Archaiologika Analekta ex Athenon/Athens Annals of Archaeology* 4, 12–26.
- Papathanassopoulos, G. A. (1972) Σπήλαια Δυρού. *Archaiologikon Deltion* 27, Chronika, 251–255.
- Papathanassopoulos, G. A. (2011) *Το Νεολιθικό Διρό, Σπήλαιο Αλεπότρυπα*. Athens.
- Pentedecka, A. (2005) *Technological and Provenance Study of Black Burnished Neolithic Pottery from Alepotrypa, Diros Cave, Laconia: Final Report of Petrographic Analysis*. Unpublished Fitch Laboratory, British School at Athens, Internal Report.
- Petrocheilos, A. (1965) Descriptions des grottes visitées, I. La grotte Alepotrypa No. 923. In *IV Colloque International de Spéléologie, Premier en Grèce, Athènes 1963*. (Société Spéléologique de Grèce XXIV–XXXVI). Athens.
- Petrocheilos, A. (1962) Το προϊστορικό σπήλαιο της Αλεπότρυπας. In *Πελοποννησιακή Πρωτοχρονιά* VI, 338–340.
- Phelps, B. (2004) *The Neolithic Pottery Sequence in Southern Greece*. (British Archaeological Reports S1259). Oxford.
- Phelps, W. (1975) *The Neolithic Sequence in Southern Greece*. Unpublished PhD dissertation, University of London.
- Pilides, D. (2000) *Pithoi of the Late Bronze Age in Cyprus. Types from the Major Sites of the Period*. Nicosia.
- Rak, O. (2011) *The Rhyton from Danilo. Structure and Symbolism of a Middle Neolithic Cult-Vessel*. Oxford.

- Rammou, A. (2011) *Ανοιχτά Ακόσμητα Αγγεία της Νεότερης Νεολιθικής Περιόδου από το Σπήλαιο Αλεπότρυπα Διρού*. Unpublished PhD thesis, University of Thessaloniki.
- Rathosis, C. (2005) *Αρχαιολογικά Κεραμικά ΒΔ Πελοποννήσου και Προέλευση των Πρώτων Υλών τους: Πετρογραφική, Ορυκτολογική, Γεωχημική και Αρχαιομετρική Προσέγγιση*. Unpublished PhD thesis, University of Patras.
- Renfrew, C. (1972) *The Emergence of Civilization. The Cyclades and the Aegean in the Third Millenium B.C.* London.
- Renfrew, C., Gimbutas, M. and Elster, E. S. (eds) (1986) *Excavations at Sitagroi: A Prehistoric Village in Northeast Greece*, 1. (Monumenta Archaeologica 13). Los Angeles.
- Sampson, A. (2008) *The Sarakinos Cave at Akraephion, Boeotia, Greece, I: The Neolithic and the Bronze Age. Pottery Analysis, Cave Occupation Patterns and Population Movements in Central and Southern Greece. I: The research from 1994–2000*. Athens.
- Sampson, A. (1981) *Η Νεολιθική και η πρωτοελλαδική Ι στην Εύβοια*. Athens.
- Sampson, A. (1988) *Η Νεολιθική κατοίκηση στο Γυαλί της Νισύρου*. Athens.
- Sampson, A. (1993) *Σκοτεινή Θαρρουνίων, Το σπήλαιο, ο οικισμός και το νεκροταφείο*. Athens.
- Sampson, A. (1996) *The Cave of the Cyclops, Mesolithic and Neolithic Networks in the Northern Aegean, Greece. I: Intra-site Analysis, Local Industries, and Regional Site Distribution*. (Prehistory Monograph 21). Philadelphia.
- Sampson, A. (1997) *Το σπήλαιο των Λιμνών στα Καστριά Καλαβρύτων: Μια προϊστορική θέση στην ορεινή Πελοπόννησο*. (Εταιρεία Πελοποννησιακών Σπουδών 7). Athens.
- Sampson, A. (2002) *The Neolithic Settlement at Ftelia, Mykonos*. Rhodes.
- Sampson, A. (2003) *Η Νεολιθική περίοδος στα Δωδεκάνησα*. (Archaiologikon Deltion Δημοσιεύματα 35). Athens.
- Sherratt, A. G. (1986) The pottery of Phases IV and V: the Early Bronze Age. In C. Renfrew, M. Gimbutas and E. S. Elster (eds) *Excavations at Sitagroi: A Prehistoric Village in Northeast Greece*, I, 429–476. (Monumenta Archaeologica 13). Los Angeles.
- Sperling, J. (1976) Kum Tepe in the Troad. Trial Excavations, 1934. *Hesperia* 45, 305–364.
- Spitaels, P. (1982) Final Neolithic Pottery from Thorikos. In P. Spitaels (ed.) *Studies in South Attica I*, 9–44. (Miscellanea Graeca 5). Ghent.
- Spyropoulos, T. and Spyropoulos, G. (2012) Σφακοβούνι Καμενίτσα. In A. Vlachopoulos (ed.) *Αρχαιολογία: Πελοπόννησος*, 258–259. Athens.
- Theocharis, D. R. (1951) Ανασκαφαί ἐν Παλαιά Κοκκινιά Πειραιῶς. *Praktika* 106, 116–122.
- Touloumis, K. (1994) *Το πλεόνασμα στην προϊστορία και η Αρχαιολογία της αποθήκευσης*. Unpublished PhD dissertation, University of Thessaloniki.
- Treuil, R. (1983) *Le Néolithique et le Bronze Ancien Égéens, Les problèmes stratigraphiques et chronologiques, les techniques, les hommes*. Paris.
- Tsountas, C. (1908) *Αἱ Προϊστορικαὶ Ἀκροπόλεις Διμηνίου καὶ Σέσκλου*. Athens.
- Van Effentere H. (1983) The economic pattern of a Minoan district: the case of Mallia. In O. Krzyskowska and L. Nixon (eds), *Minoan Society: Proceedings of the Cambridge Colloquium 1981*, 61–67. Bristol.
- Vitelli, K. D. (1993) *Franchthi Neolithic Pottery 1: Classification and Ceramic Phases 1 and 2*. (Excavations at Franchthi Cave, Greece 8). Bloomington.
- Vitelli, K. D. (1994) Experimental approaches to Thessalian Neolithic Ceramics: Gray Ware and ceramic color. In R. Misdrahe-Kapon (ed.) *La Thessalie: Quinze années de recherches archéologiques, 1975–1990. Bilans et Perspectives. Actes du Colloque international Lyon, 17–22 Avril 1990*, 143–148. Athens.
- Vitelli, K. D. (1999) *Franchthi Neolithic Pottery 2: The Later Neolithic Phases 3 to 5*. (Excavations at Franchthi Cave, Greece 10). Bloomington.
- Vitelli, K. D. (2007) *The Neolithic Pottery from Lerna*. (Lerna V). Princeton.
- Weinberg, S. S. (1962) Excavations at Prehistoric Elateia, 1959. *Hesperia* 31, 158–209.
- Weinberg, S. S. (1965) The relative chronology of the Aegean in the Stone and Early Bronze Age. In R. W. Ehrich (ed.) *Relative Chronologies in Old World Archaeology*, 285–321. Chicago.
- Weisshaar, H.-J. (1989) *Die deutschen Ausgrabungen auf der Pevkakia-Magoula in Thessalien I. Das späte Neolithikum und das Chalkolithikum* (Beiträge zur ur- und frühgeschichtlichen Archäologie des Mittelmeer-Kulturrumes 28). Bonn.
- Zachos, K. (2008) *Ayios Dhimitrios, A Prehistoric Settlement in the Southwestern Peloponnese. The Neolithic and Early Helladic Periods*. (British Archaeological Reports S1770). Oxford.

When do the dead become dead? Mortuary projects from Ossuaries I and II, Alepotrypa Cave

Stella Katsarou

Introduction

The information garnered from Alepotrypa Cave introduces radical changes to the picture of Neolithic Greece concerning our understanding of funerary practices and the ideology of death. Other contributors to this volume demonstrate the excellent quality of the evidence this cave has yielded with regard to population size, the multiplicity and extent of funerary episodes, and their overlap with the many and diverse domestic uses, as well as ceremonial practices which may, or may not, involve human burial.

The focus here is on Ossuaries I and II, found at two different locations in the cave. I have examined the pottery of these sites and have shaped a funerary scenario with the aim of addressing issues of social performance through mortuary practice. The techniques of burial deposition in each ossuary and the finds that occur with the deceased, specifically the fragmentation of the funerary artefacts, are assessed. Going beyond the conventional characteristics of such qualities as style, the level of the skill displayed in the manufacturing processes, or the practical viability of the finished products, I look for possible links of the deposited fragments with, and influences exercised by, the societal demands and requirements of the living.

The physical and temporal distance between the two funerary loci, one located at the cave entrance and the other in the dark interior of the cave, does not make them mutually independent. It is obvious that those conducting burials in both locations share the common mainland Neolithic cultural background with respect to the long-term sequence of material style. But the significant factor here is that the Neolithic populations at both ossuaries shared the cave *itself*: it is the home ground of their fathers and mothers, where communal memory stretching down

to their lifetime is ‘deposited’ along with the bodies of their dead.

Social synergy and memory in context constitute my theoretical framework for understanding how this legacy is translated into the actions undertaken and the material things offered at the two sites. Elsewhere I have already set forth (Katsarou 2017) my position: I argue that the ‘horizontal’ and trans-contextual avenues, employing typological, technical and statistical approaches towards the pottery, as conventionally practised in Greek Neolithic scholarship, are far removed from providing any real insight into the plurality of lived experience and its social appropriation of the Neolithic past. In putting this contextual perspective forward here, I explore the cultural-artefactual evidence in play at the ossuaries as an intellectual and social apparatus designed to confirm social relations and institutions (Skourtoupoulou 2006) along biographical and family lines. Given my keen interest in an interactive concept of the material past, I seek to demonstrate how small-scale mortuary decisions influence long-term strategies of the living. I employ a vocabulary and idiom that is rooted in community and family, and referenced in time, to delineate the persona of these Neolithic people as expressed through their mortuary performance in Ossuaries I and II in Alepotrypa Cave.

Ossuary I

Reutilised funerary space

Ossuary I defines a cluster of loci (A3a, A3b, and A4) extending along the west side of the large stalagmite column attached to the irregular cave wall: this is sited a few metres to one’s left, as soon as one passes through the present entrance of Alepotrypa to Chamber A (see

Papathanasiou, Chapter 2, Figure 2.8). If one accepts that the ancient opening to the cave was at the same place as the present, although this is still debated, Ossuary I would have lain close to it and benefited from natural light. Roughly speaking, A3 lies at the front and west side of the column, orientated N–S to the chamber wall, and A4 is located deep inside the west niche formed between the column and the cave wall. Neighbouring loci A5, A6, and A8 that extend from the present cave opening along the north bedrock wall to A4 are arbitrarily demarcated, given that the contextual difference in the number and type of deposited burials between them is not absolutely clear. Whether prehistoric mortuary concerns had established real boundaries between loci A3 and A4 and those locations preceding and succeeding them is an issue that will be fully addressed when the entire series of contexts along the north wall of Chamber A are studied and compared.

Loci A3a, A3b, and A4 were partially explored during the first year of fieldwork undertaken in the cave in 1970–1971, with the eager expectation that intact deposits from Petrocheilos's extensive removal of the entrance fill in the 1960s (Papathanassopoulos 2011, 29, fig. 17) would yet survive. The deposits were excavated to a depth of 0.55 m and 1.25 m in A3a and A3b and to 1.20 m in A4. According to Papathanasiou (2001, 33, 2009, 23), the overall impression of the context was that of an enormous, disarticulated mass of human bones from secondary burials packed together, with only small quantities of soil among them. Some bones as well as a skull were reported as possibly intentionally surrounded by a circle of stones. The skulls of two dogs and the mandible of a cow were identified as having been deliberately placed with the dead (Papathanasiou 2009, 23). A considerable number of potsherds among these piled bones were reported to date from the LN/FN, but also included EN material.

Additional fieldwork carried out in 1994 reached part of the bedrock inside the niche at location A4. According to Papathanasiou's description (2001, 33), deposits were uncovered deeper than those excavated during the 1970 campaign, revealing a sequence of primary and secondary child mortuary material at this location. Specifically, lower down in the top stratum, a heap of disarticulated child bones was uncovered: the child's skeleton was lying on flat slabs, propped up by well-arranged stones (in a secondary phase of activity). An underlying stratum contained the articulated burial of another child also carefully propped up and this time covered with stones, their flat faces now resting on the bones (a primary interment). Finally, a third stratum, lying on the bedrock, contained a tiny heap of bones from newborn twins: these were placed directly on the natural bedrock, after some basic preparation of its surface had been undertaken (another secondary burial).

A series of radiocarbon dates from each of the three sequenced burial contexts cluster at the very end of 7th millennium BC (Karkanas, this volume), suggesting but a

short interval of time had elapsed between these recurring burials of children carried out by EN families.

The ceramic fragment scatter

The occurrence of pottery fragments in EN primary burials excavated in Ossuary I in 1994 is very sporadic. In the primary and secondary burial masses excavated in the area in 1970, however, the material evidence is rich in terms of ceramic fragments (Table 5.1) and contains very few stone and bone tools. Although the context was described as an assemblage of disarticulated bones packed together (Papathanasiou 2001, 33), detailed study of the coordinates of the recorded pottery groups found throughout has traced a possible broad chronological sequence between the FN and the EN according to depth. The dating was determined by morphological and stylistic attributes on a total of 99 potsherds from FN, LN/FN and EN (or even possibly also EN/MN). It should be noted however that within this mass a scattered distribution can apply for some contemporary pieces, and at the same time that a spatial overlap occurs for some pieces that are temporally remote. Accepting then a credible contextual coherence, the Ossuary I assemblage as a whole may be explored for sub-assemblages that could signal single, secondary mortuary depositions within the specified date-ranges (Table 5.2).

Table 5.1. Ossuary I. Number of ceramic fragments per specific spot and year of fieldwork

	1970	1994	No date	Total
A3a (EN)	2	–	–	2
A3a (LN/FN)	–	18	–	18
A3a (FN)	4	–	–	4
A4 (EN)	22	2	–	24
A4 (LN/FN)	33	4	–	37
A4 (FN)	7	–	–	7
No info (LF/FN)	–	–	6	6
No info (FN)	–	–	1	1
Total	68	24	7	99

Table 5.2. Ossuary I. Number of ceramic fragments per stratigraphical context and date

	EN	LN/FN	FN	Total
Group 10 (A3a)	1	–	1	2
Group 12 (A3a)	1	–	1	2
Group 32 (A3a)	–	–	2	2
Group 423 (A3a)	–	18	–	18
Group 9 (A4)	–	3	6	9
Group 13 (A4)	1	9	1	11
Group 21 (A4)	2	7	–	9
Group 26 (A4)	6	6	–	12
Group 31 (A4)	3	5	–	8
Group 36 (A4)	10	3	–	13
Group 469 (A4)	1	–	–	1
Group 470 (A4)	1	4	–	5
No info	–	6	1	7
Total	26	61	12	99

Early Neolithic (CPII 1)

Pottery dated from the EN within the A4 (1970) mass roughly conforms to two contextual clusters. The upper cluster across stratigraphical groups 21–31 has been tied together by the distribution of pieces from the same pot (436, 437); it contains plain concave bowls (65, 408, 417, 427, 431), bowls bearing lugs (436, 437, 438), and a possible jar (451).

The lower cluster can be considered as marking a second distinct EN context (group 36). It comprises fragments from convex bowls (62, 68), plain concave bowls (407, 430, 433, 434, 440), a concave bowl with a lug (418), as well as pieces from an everted bowl and an insloping-sided vessel (413, 414).

A few potsherds displaying diagnostic early features have been recovered from the four child burials of the 7th millennium inside the niche of the stalagmite (A4, 1994): they include a vertical lug-handle on a red polished bowl wall (409) and a fragment from a concave rim (435).

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This meagre EN pottery assemblage from Ossuary I includes in particular plain-rimmed, thin-walled convex bowls (62, 65, 68), and concave bowls (406–408, 415, 427, 429, 430–434), as well as a few bowls with a slightly differing rim (418, 440), a conical bowl (417) and a deep bowl with walls converging to the mouth (414). Possible concave jars (435, 451), and an everted-necked version (413), exist. The few vertical and horizontal lugs (418, 438), thin horizontal ribs (436, 437), and even a lug handle (409) serve to recall these widespread features from the EN and early MN period. They are here very closely paralleled with pieces from Kouphovouno (Mee 2009a, fig. 7), Lerna and Franchthi Cave (Vitelli 1993, 2007, CD photo 3).

Potters most regularly use a sparsely gritted fabric, as macroscopic observation shows. The fabric occasionally acquires a soapy texture after firing (62, 65, 68). In some cases the fabric shows densely packed limestone inclusions (406, 413, 415, 417, 418, 427, 429, 432, 436–438, 440), which typically are now visible when surface has worn off. A similar picture of dense and exposed lime grit is indicated by Vitelli's early lime-ware from Franchthi (1993, Lime Monochrome Burnished) and Lerna (2007, Lime ware, CD photos 3g and 4), as well as at Kouphovouno (Mee 2009a, fig. 7). Coincidentally, I have observed the same in late EN pottery from the Cave of the Cyclops in the Northern Sporades (Katsarou 2008).

Visible in the early pottery from Ossuary I is evidence of the potter's forming actions: coiling is the technique used for the fabrication of plain, thin-walled convex bowls (62, 68). In one example, the potter has smeared on the top of the coil to form the rim and the wall of the bowl. In a few other cases he has manufactured the vessel by pinching (436, 437) or pulling up the clay to finish the concave upper part (451), and by scraping the interior to remove surplus clay (418).

Most often the potters would fire their vessels unslipped in a fully or almost fully oxidised atmosphere, so rendering them generally reddish, red-brown, or light brown in colour inside and out, and throughout the core. The surface may have been spoiled at times by few grey or light brown clouds (418, 431, 433), denoting direct contact with fire in the firing pit; sometimes the darkened body area is affected locally right through to the interior surface. Some pots however show a grey core underneath the light-coloured surface (62, 65), which matches with Pentedeka's similar observations on ceramic material from various locations inside the cave, explained as the result of insufficient firing (Pentedeka, this volume).

Fragment 409 is the only specimen to show on both sides a red-slipped and burnished surface of lustrous quality. One may even make out visible traces of the potter's hand motions in polishing around the handle. Vessels that had been slipped are more usually fired to brown, brown-grey or grey colours (407, 417, 413, 418, 427, 430); they may also carry a darker colour or hue on the inside, possibly resulting from the pot being inverted in the firing pit (417, 436, 437, 440, 451). Even more specifically rim fragments 440 and 451 bear at the rim a thin black band: this extends a little over the rim from the interior dark-fired surface to the exterior. This effect is created by restricting exposure of the exterior rim to oxygen, as it was buried in soil or ash once the pot was turned upside down in the firing.

Some of the above features (polished red lug handle, black-topped rims, lugs) may be indicative of a later EN or even an EN/MN date.

Late/Final Neolithic (CPII 2 and 3)

We can perhaps distinguish three consecutive clusters of pottery fragments across the central and upper part of the stratigraphy of the Ossuary I disarticulated mass of human bones. It is assumed here that they are associated with different burial episodes. Their closer assignation to LN and FN is here attempted, but with caution, as their morphological attributes are not always tightly fixed chronologically.

Starting in reverse from the upper and most recent context, that of A4 testifies to a cluster of fragments of possible FN date recorded across the upper level of the massive assemblage (groups 9, 13), singled out by their coarser fabric. Identifiable vessels include a deep converging jar (422, 453), a collared pot (425), a plain coarse shallow bowl (412), a very shallow coarse bowl bearing a lug or a foot (419), alongside more coarse containers carrying lugs (420, 421, 426), and also a thin-walled shallow S-profile bowl (411). Their macroscopically distinct coarse texture is generally reminiscent of the technological shift towards more densely gritted fabrics, as generally attested by FN.

The next cluster (groups 9, 13) within the Ossuary mass consists of fragments from thinly-gritted light-

coloured concave rims (66, 69, 416) and a grey one (424), that may belong to carinated bowls ($\Delta 9583$, $\Delta 11579$, 64), along with fragments of a black scoop or rhyton (455), probably also a flaring bowl (61) and a fragment from a collared form (423). A broken bone borer should be also assigned to this group (Papathanassopoulos 2011, 138, no. 83). The black scoop and the carinated bowls more safely point to an LN or even LN/FN date.

The next underlying discernible cluster, although it partly overlaps physically with the EN context described above, contains LN/FN features. It is composed of a large group of fragments extending across a range of different levels and stratigraphical records (groups 21–36), but is judged to be essentially coherent on account of the extended scatter of 16 fragments coming from perhaps one or at best two similar containers of a very wide, high and concave shape (see typically 390, 391, 395, 402). These fragments compare well with pieces mending up into a comparable wide and high container in Ossuary II (Figure 5.10, no. 452). With them, more ceramic pieces include parts from a plain shallow bowl (441), a vertical strap handle (428), a pedestal foot (410), and a number of concave rim fragments (63, 454).

Additionally there is some LN/FN pottery excavated from A3a in 1970 and 1994: it is of poor quality, comprising small and undiagnostic body fragments, except maybe a piece of a concave rim (46) and one from a shallow black convex bowl (57). A few pebbles of various colours and shapes also come from the same context: amongst them are a bright white symmetrically round pebble, one grey and one buff elongated stone of rounded profile, and a small grey prismatic item.

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In terms of an overall technical and morphological assessment of the LN/FN and FN pieces, there is evidence for pinching-up from bowl 412 and scoop-rhyton 455, as well as for pulling to fashion the rim (61, 453). More evidence for pinching comes from FN vessel 425. One plausible example of the paddle and anvil technique is discernible (420) in the certain final cluster of Ossuary I. Further evidence for this forming technique is known both from vessels in Ossuary II and in deep jars collected from the interior location $\Theta 27$, near the lake.

The LN scoop-rhyton (455) was manufactured by pinching it up out of a lump of fine clay, to which were then attached separately fabricated legs that had been smeared around a thick core. After carelessly incising a line along the rim and another around the foot attachment, and adding a few short vertical hatches on the body, the craftsman had slipped it, given it a burnish and fired it to full monochrome black. This ceramic fragment showed considerably more wear-damage at its edges than the rest of the cluster, which implies that it had been subjected to a lengthier episode of taphonomic weathering.

Table 5.3. Ossuary I. Number of pottery fragments per date and vessel shape

	EN	LN	FN
Bowl convex	4	–	3
Bowl carinated	–	3	–
Bowl close curved	–	1	–
Bowl concave	11	7	–
Bowl concave rimmed	4	2	1
Bowl (other)	1	6	2
Large basin	–	16	–
Bowl converging	–	–	1
Bowl everted	1	–	–
Converging	1	–	–
Jar close curved	–	–	1
Jar collared	–	1	1
Jar concave	1	1	–
Jar converging concave	–	1	–
Jar (other)	–	2	1
Pedestalled	–	1	–
Scoop-Rhyton	–	1	–
Bodies	3	19	2
Total (99)	26	61	12

The potters used a similar fine fabric to form the two LN/FN carinated bowls ($\Delta 9583$, $\Delta 11579$), producing both a smaller (rim diam. 14 cm) but deeper size and a wider (rim diam. 21 cm) and more shallow-profiled version. The thin fabric they exploited to manufacture an even broader range of LN/FN concave and flaring bowls, which they would slip and fire, preferring a light buff (61, 63, 66, 69, 416). Some of these vessels had a grey core underneath their slipped surface (61, 416), due to their partial reduction in the firing phase.

Coarser fabrics were used for a rather broad range of FN ceramic containers, including shallow concave vessels (63, 66, 69), flaring rimmed bowls (61), plain conical bowls (416), necked jars (423), insloping concave (424) and insloping deep (453) vases. Some attachments, now broken away, from the coarse fabric vessels include a thin vertical strap handle (428) and a pedestalled foot (410). Scraping marks are rare and cannot be easily discerned from use wear traces. One fragment preserved a possible soot deposition on the inner surface.

Potters would more often fire these coarse pots to a red or dark brown. The large container (390–405), of both a high and deep profile, is made with a very distinct technique and morphological properties, showing a LN date: thick-walled, coarse and slipped, it is well fired to a black throughout the interior and the core, with a greyish-buff exterior having a narrow black-topped band at the rim area.

This LN/FN context is the source of the few other goods in Ossuary I: two stone axes, a ferruginous heavy and round stone artefact, and a burnt and broken borer of bone. They are all heavily worn to the point of uselessness (Papathanassopoulos 2011, 97–98, nos 34 and 35; 140, no. 85). The iron-rich stone (probably hematite) weighed 91.9 g (Papathanassopoulos 2011, 108, no. 52), and

had acquired its rounded form due to deliberate hand-polishing. The context contains also a small number of pebbles and rougher-shaped stones, one of a distinct green colour: these seem to have been deliberately collected to be placed with the bones. The contemporary incidence of a large basin, a stone ax and more ferruginous round stones in Ossuary II in the interior of the cave (see below) signals these as artefacts that may be repeatedly present in mortuary contexts. This aspect is discussed further at the end of this chapter.

'Dead' vessels

The present assessment of the material evidence from Ossuary I suggests that the diachronic mortuary practice at the stalagmite-niche close to the cave entrance by both the EN and LN/FN communities of Diros was the outcome of social membership and ritual display, where pottery played varying roles.

Based on three late 7th millennium BC episodes of secondary burial in Ossuary I, the anthropological study carried out by Papathanasiou (2001) has indicated that the first and the last show deliberate disarticulation of the dead children, who had probably decomposed on this very spot. Their bones had been propped up into demarcated heaps, perhaps to keep their remains visible. However, as every EN activity followed hard on the previous one, perhaps occurring within the same generation or even sooner, the displayed bones were covered shortly under a new, but thin, layer. Although such transformative practices and occurrences are obvious, evidence of the offering of non-perishable gifts is, to all intents and purposes, absent. The paltry traces of the few EN body sherds may have been from items once in the existing fill or from the soil brought in from nearby to cover the bodies.

Carefully laid-out child burials are also known from a few other Neolithic sites in the Peloponnese (Perlès 2001; Georgiadis 2009; Fowler 2004, 28), but constitute inhumations in pits or in caves (Triantafyllou 2008). These do not display the post-burial treatment such as the construction of small visible heaps of bone, but do attest to location marking with the use of stone piles. Apropos of secondary treatment, the most notable instance in the Greek EN record remains the ossuary of skulls assembled under a house floor at Prodromos, Thessaly (Hourmouziadis 1971), which may be compared with later mortuary patterns of skull treatment here in Ossuary II, but not with the EN record from Ossuary I. Perlès's (2001) comment on the vast absence of data and the possible biased picture we get from the occasional surviving burial and ritual act, which may be atypical, should be borne in mind.

It was not until a long while later, in LN/FN (though hints of the same in EN/MN are probable), that the Neolithic communities of Diros revisiting Ossuary I frequently and repeatedly left a new pile of dismembered skeletal parts, this one now coming from many individuals

representing a full age range (Papathanasiou 2001). The mass burial, resulting from the purposeful revisiting of the stalagmite niche at the entrance, became severely disordered by the successive introduction of new skeletal material transported from other places where primary decay had taken place, and which had lost their corporeal integrity. The arguably deliberate emphasis accorded to one human skull by its being marked out by stones and post-cranial bones may indicate that some instances of more elaborate mortuary performance occurred occasionally at this location.

By pursuing this analysis of the EN-to-FN mortuary topography of Ossuary I, we have teased out that the living community demonstrably cared for the dead across a longer period, rather than only at the time of their interment. (Discussion of this staged practice will be reserved for the end of the chapter alongside the discussion of the extensive program of mortuary display of similar date from Ossuary II.) Focusing here on the material remains from the LN/FN context of Ossuary I, I have observed that the large quantity and full range of pottery that has survived in fragments and of all different episodes contrasts with the scarcity of ceramics in the EN phase. Despite the apparently bulky volume of this context at first sight, consideration of the coordinates of finds across the assemblage has actually produced some (speculative) results on possible artefactual clusters that may correspond to individual episodes of deposition. From this evidence, the most extensive event of the LN/FN assemblage involved the transportation of material en masse and the accumulation of a large fill, significantly increased by a rich content of ceramic fragments and other funerary gifts.

Thus we arrive at the certainty that it was always fragments that accompanied each funerary deposition in this context. Fragmentation has indeed been an absolutely intrinsic component to Ossuary I, something material that was socially and individually understood. This fragmentation takes two forms.

For the most part, the broken pottery represents the secondary occurrence of ceramic fragments as singletons from a large range of pottery vessels which had become intermixed at an earlier stage when they were discarded after practical domestic use. Their fragmented size-range is in keeping with the taphonomic standard for mingled big and small body sherds, one that is typical for usual domestic disposal. The poorer state of preservation of some, such as the piece of the scoop-rhyton (455), points to their having been in a broken state for long before their final deposition.

There is a range of possible interpretations to explain how these ceramic fragments arrived at the mortuary context of Ossuary I. Since the spot had a mortuary history for several generations, I consider any claimed domestic activity occurring here before the LN/FN mortuary events to be doubtful, and therefore suppose that this ceramic

scatter is unlikely to have originated from a local domestic level. On the other hand, since most pottery fragments have but a slightly eroded surface, this would imply that their origin had not been from far away, and that they had not undergone any repeated ‘recontextualisation’ within recycled or displaced deposits of any sort. Given this evidence, I would find it easier to believe that these ceramic loners were intermixed with the fill during the course of the mortuary deposition as practised by the living community, the intentional aspect of which I discuss below.

In the meantime, let us consider the matter of the larger fragments – whether they too can be interpreted to fit context-specific mortuary practices as argued for the smaller pieces. Fragments from two carinated bowls and a wide and deep basin (390–405) are of concern here. Sizeable fragments, including those from the shallow coarse basin (419) and possibly yet more pieces (more difficult to identify the shape), add to this total. The robust basin would have enabled preparation and transport to the site of a large volume of food, suited to a gathering of people, while the small bowls seem more likely to pertain to the consumption of an individual portion of food. It is possible that these pieces were introduced as whole pots to the location, and were used for cooking, food processing and food sharing in the context of some act of remembrance and veneration of the dead (Hamilakis 1998), before they were fragmented for deposition. The spectacle of the skull’s arrangement, the most salient feature in the assemblage, may have been the context in which these vessels participated.

Broadly speaking the recognition of one particular vessel category or shape as a deliberate and exclusive burial gift (other than as a burial container) is not found in Neolithic scholarship. In the discussion of Ossuary II below, I will argue for that case, using as comparanda material from domestic assemblages, although I would leave a window open for the scoop-rhyton vessel (455) and the large basin (390–405). The scoop has been once again attested at the cemetery of Kephala, but it has been recorded in vast numbers in domestic contexts too: the picture from it is thus ambiguous. Mee (2014) has summarised the literature and the associated ritual function for this very particular legged Neolithic vessel. The basin however is a more likely candidate for mortuary use: a similar container in terms of profile and size has been retrieved among the mortuary debris of contemporary Ossuary II. Therefore the possibility exists that this large food container was a piece of habitual equipment used in the mortuary context of Alepotrypa for serving the commensal practices connected with the displayed bones. Tracing its use in domestic circumstances within the cave is a project in progress.

The deliberate deposition of parts of these containers at the end of the feasting may account for what is found. Moreover, the fact that some blunt stone artefacts (axes,

polished stone) occurred alongside the potsherds in the LN/FN mortuary context provides a further argument for the deliberate deposition of gifts to the deceased, which in turn strengthens the chances that at least these pieces of pottery were gifts too. However nothing can be said about complete vessels that are brought in to be ‘killed’ in this mortuary milieu, as it is not likely that any ceramic container would be entirely retrieved in all its fragments here.

Arguably, be they larger or smaller, broken *in situ* or introduced from other contexts, ceramics in Ossuary I are fragmentary in nature. I would restate the matter of the two different statuses of fragmentation in one simple question: was this disarticulation a fundamental and deliberate aspect of the objects deposited with the deceased in Ossuary I? Would not the living, busy with the mortuary project, have noticed the random occurrence of body sherds in the soils brought in from elsewhere to cover or prop up their dead? Would this worthless ceramic scatter from living contexts have been viewed as in significant contrast to the larger and deliberately broken pieces?

Given the limitations of the evidence, I will not pursue these hypotheses about fragmentation any further, other than to point out that however and whenever the ceramic vessels became fragmented in Ossuary I, it was this broken state that was sought after for the burials. Either as visible pieces already in the fill and left there, or as intentionally collected pieces sought in the immediate neighbourhood, or even brought over from some domestic rubbish heap or such to ‘temper’ the funerary fill, all such fragments can be seen as desired and embedded. Even the further breakage of existing fragments at the funerary locale cannot be excluded.

Looking at the broader picture of the Neolithic and the specific context of Ossuary I once again, I would acknowledge Chapman’s attractive ideas on the concept of fragmentation (2000; Chapman and Gaydarska 2007) and dispersal as contributing to our understanding of the social transformations occurring at this spot in the cave. But one cannot extrapolate from the part to a whole in some simple, straightforward way. The part-as-whole reading may find some philosophical support when broken gifts are seen as symbolically representing metaphysical goods valuable for the afterlife (Ucko 1969; Parker Pearson 1999).

Leaving aside this notion of completeness, let alone that of artefactual discard, which after all are only our readings of the situation, the individual fragment may have existed in its own right (Last 2006), endowed with some symbolic potential. Transcending our present biases founded upon the juxtaposition on the one hand of completeness, manufacturing competence, and pristine condition against, on the other hand, fragmentation, poor standards of production, and damage from exposure to time and utilisation, we are more likely to appreciate the rich potential for shared values these numerous, humble

pieces from pots in Ossuary I may have borne. Apart from some social significance, any such single potsherd can be a discrete focal point of personal biography and memories. Indeed in different contexts – be they cultural, personal or circumstantial – parts and wholes may overlap in import or obtain individual importance. Brittain and Harris (2010) would categorise such as neither part nor whole, but an integral element in a connective flow both incorporating a range of social and personal substances, as well as denying generic roles based on a dependence on specific scales where the transformations occur. As Talalay (2004, 155–156) points out, within the Greek-Anatolian Neolithic context, notions attaching to a broken object apropos the fragmentation of their integrity and loss of their power were more nuanced; pieces are seen as enduring, even acquiring more power and moving into a new symbolic domain after detachment and breakage.

The certain deposition of fragments in Ossuary I over a period of time potentially argues in favour of the existence in the community of customs based on a way of thinking in which an ideology of fragmentation persisted, one kept powerful and meaningful through the succeeding generations. The emergence of fragmentation as a social practice, where fragments of items stand in as symbols for human life histories, has been argued as comprising one of the central processes in human existence (Gamble 2007). Chapman's particular reading of enchainment through fragments, where a person is manifest through a nexus of relationships (Brittain and Harris 2010), can be taken further to deal with the concepts of rebirth and reincorporation through the fragmented material bodies (Brück 2006a, 2006b; Schoep and Tomkins 2016).

Skeletal dismemberment as part of the course of death has long been an enduring practice capable of lasting for millennia in a cultural context (Cullen 1995, 1999). Now this physical process is supplemented by artefactual dismemberment. The breaking-up of pots as they are deliberately discarded by people, alongside any naturally occurring fragmentation, becomes equated in the mortuary context with the physical and human-processed dismemberment of the deceased. The pottery is utterly 'consumed', so making it cease to exist and become 'dead' – just like the humans. It is an aggressive process, equivalent to a species of 'devouring' (Hamilakis 1998) of all the components of the living world in the mortuary context. As well as the pottery fragments that the living community had broken or collected, this practice can involve stone tools exhausted to the point of uselessness, pebbles symbolising a destroyed living floor, animal bones, let alone more perishable materials, standing in for fresh and cooked food (likewise consumed at the burial ground). I mention only in passing the involvement of animal bones in the skull-worshipping context seen in Ossuary I (cow and dog mandibles): such may possess a symbolic, ritual component rather than being pieces

of mere food residues, so opening the opportunity for exploring the matter as part of an integrated study. The correlated deposition of animal and human bones has also been a widespread phenomenon in central European and extending as far as Levantine Neolithic mortuary beliefs and practices: instances are known when human skulls or body parts are disarticulated and combined with animal teeth, skulls and mandibles (Borić 2014; Goring-Morris and Birkenfeld 2008, regarding the site at Kfar HaHoresh). Furthermore in Anatolia the relation between bucrania and human skulls has been expressed in monumental terms (Relke 2007).

Symbolising the self-referencing notion of both human and material fragmentation in a transcendence of the dualism of life and death (or the complete versus broken), bones and parts thereof constitute a context merged with and mutually interactive with the daily life of the community of Ossuary I. It is important to reiterate that this transformative flow of consumed human and material matter was operating at one and the very same location (Ossuary I), transforming it into a distinct 'landscape' understood for generations. It is not only the potent territory which has been brought into being by mortuary practice, but also the continuity of the practice in Ossuary I that combines to ensure that it became a lasting place of social significance. The social and territorial links are absolutely interwoven, bound together – the one activates the other and both are continually mutually replenished by the personal and collective values forged over the dead bodies. Memory is the unifying substance that bonds the material and spiritual parameters of this never-ending venture, fixing them to this spot by now untraceable procedures of deliberate or spontaneous acts that lie beyond our ability to attest. Fragmentation is the persistent way of understanding death in its varying contexts. The disarticulated material is then revisited, as it has been transfigured to meet the community's values on collective memory, identity and social coherence. Pieces of bodies and things have become the linking mnemonic device tying the dead with the living and the past of the community with its future. The mnemonic aspect of fragmentation may account for practising vessel, figurine, and tool killing in various non-funerary Neolithic contexts, including cave rituals such as in Franchthi Cave (Talalay 1987) or the Cave of the Cyclops (Katsarou 2008), or residential areas, such as at Kremasti Koilada, Kozani (Hondrogianni-Metoki 2009; Stroulia and Chondrou 2013), even house-'killing' (Tringham 2013) to cite but a few instances, as the full Greek Neolithic record of fragmentation is beyond the limits of this paper.

As a final comment here, appropriate to introduce Ossuary II below, I would suggest that Ossuary I has provided the stimulating context for reviewing the status of the humble pot fragments – so much visible in the everyday of the Neolithic (Moxey 2008; De Marais and Robb 2013), as ignored dumped waste, and exploring

their ability to evoke new responses, and become part of a range of activities under new meanings.

Ossuary II

Skulls in a context of fragments

Ossuary II is identified as locations Θ 9 and Θ 10, which constitute the spacious and enclosed Chamber D positioned some 10 m or so after the junction of the two cement staircases leading from Chamber B to the lower level of the cave (Plan of the cave: Frontispiece; Figures 5.1 and 2). The chamber has its main axis running N–S. According to the report by Papathanassopoulos (1971, 293–299), the west and north-west parts of the space were destroyed by the construction of the cement pathway, before the start of archaeological research. However, the larger part of the space – up to the north, east and northeast boundaries of the natural rock, which contains natural niches – has been preserved. The roof of the chamber was at a maximum height of 2.50 m before the outset of the excavation; it did not present any speleothems, as it had been formed by the detachment of the rocks from the roof of Chamber C in an earlier period.

In 1970, Papathanassopoulos observed that the older construction works for the corridor had brought to light scattered fragments of skulls, bones and ceramic fragments at the surface of the chamber's fill. It was this that made the proper excavation of the site a major priority. Excavations were undertaken in August 1971. As delegated by the then General Inspector of Antiquities Prof. Spyridon Marinatos, the work was carried out in collaboration with Nicole Lambert, director of a French team conducting research in Attica at the time (Papathanassopoulos 2011, 31–32).

Using the publications of Papathanassopoulos (1971, 293–299) and Lambert (1972), as well as from the personal journal kept by Catherine Perlès, Lambert's associate at that time, who very kindly offered it to us in 2012, we may reconstruct the research conducted in Ossuary II in 1971.

The site was excavated in ten squares on a 1 × 1 m grid, laid out mainly on a N–S axis (Figures 5.1 and 2) (Lambert 1972, 851, fig. 5). Excavation was taken to its deepest level at 1.49 m at cIII, though the natural bedrock level was still not discovered (Lambert 1972, 865, pls i–ii). Two deposits are described (see also Papathanasiou 2001, 33): a surface fill 0.25 m thick, of brown soil, relatively clean of stones but also of finds, overlying a brown–grey, locally red, stratum 0.20 m thick, which contained ceramic fragments and rocks in great density. At the lowest part of this layer (Layer IIa), the largest number of skulls and human bones were found, as well as domesticated animal bones and the biggest ceramic fragments. Between Θ 9 and Θ 10 and towards the east edge of the chamber close to the natural rock, a boulder, probably fallen from the roof, was removed during the excavation. The skulls found

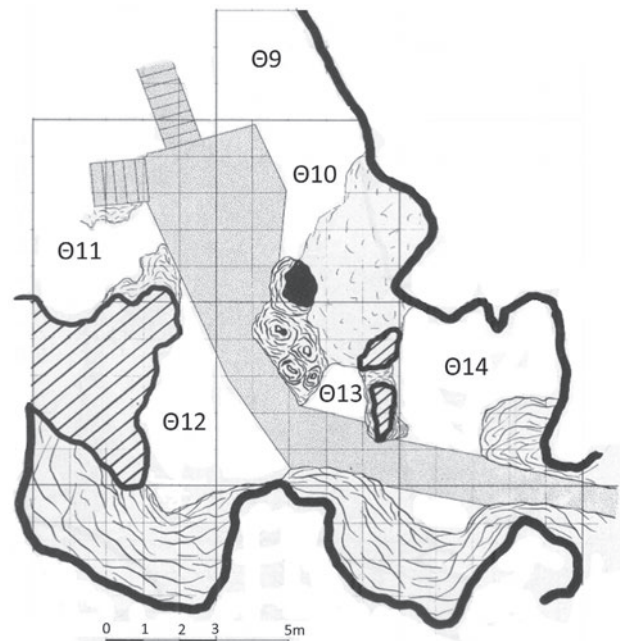


Figure 5.1. Ossuary II. Plan of locations Θ (modified from Lambert 1972, fig. 5).

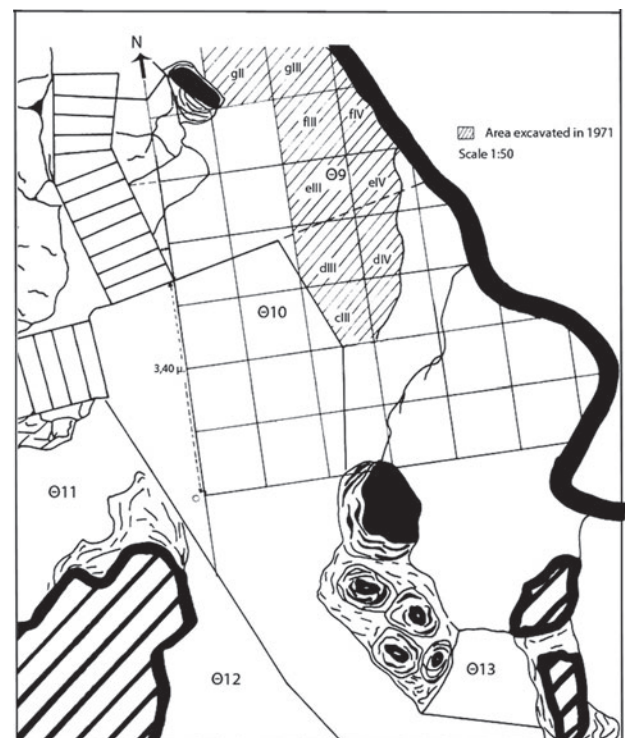


Figure 5.2. Ossuary II. Plan of locations Θ and detail of grid in Θ 9 and Θ 10 (modified from Lambert 1972, fig. 5).

under the boulder were crushed for the most part. Under this boulder was a smaller rock, apparently in place when Ossuary II was created; it was left by the excavators to demarcate the east edge of the chamber.

According to the reports by Papathanassopoulos (1971, 297–298) and the trench plans published by Lambert

(1972, 865–871, pls i–xiii), the density of the skeletal finds and offerings varied across the chamber. The majority of the skulls were found at the southern part of Θ 9 and the start of Θ 10, while further to the south their number decreases, but the quantity of pottery increases; a note refers to bowl bases ‘found the one inside the other’. The bone dispersal was random, without any specific orientation and placement (Lambert 1972, 850). At the northern part of Θ 9 skulls were found individually, placed upright without their lower jaws, and surrounded by stones, but without much pottery.

The burials lay on a stone fill composed of dark brown stones, with spots of charcoal and ash. This lower deposit contained most of the bowl fragments and the largest concentration of domestic animal bones in the Ossuary.

The human skeletal assemblage from Ossuary II comprises 14 skulls preserved with their crania intact or almost so, and a large number of post-cranial bones, also implying a large number of individuals (identified by Lambert, 1972, 861–864, and studied by Papathanasiou, 2001, 33 and 48, table 2). The ages range from infants to sub-adults and adults of both sexes, estimated to reach a maximum of 35–40 years of age.

In terms of pottery, the excavators point out the generally coarse quality of the vessels, and only occasionally refer to specific fragments, mostly bases from open containers, an S-profile bowl, black- and red-slipped thick fragments, including one with plastic ornaments (Lambert 1972, 859–860, fig. 20). Given the above reports and the contextual details marked on the reverse of each 1971 sherd, we can now partly reconstruct the material contexts of the skulls (for the location of the post-cranial assemblages, see Lambert 1972, 864).

The synthesis worked out here is as follows:

- a) At gIII, skull 1 (Lambert 1972, 853, fig. 8) was found with a fragment from a large rim-perforated bowl (140).
- b) At gII, no skull was found, but only parts from a bowl and a polished banded jar (73, 149).
- c) At fIII (Lambert 1972, 853–854, figs 9–10), skulls 2 and 3 were accompanied by fragments from bowls of convex, carinated and concave profiles, basins, as well as one deep, banded jar (71, 76, 78, 110, 125, 143, 213). In the same square, a pebble was also found, which Perlès characterised as probable polisher (Figures 5.1 and 2).
- d) At fIV, there was a fragment from a black polished concave bowl (70).
- e) At eIV (Lambert 1972, 854–855, figs 11–12), skulls 4 and 5 were accompanied by fragments from a banded jar, a deep coarse convex bowl, along with a red-burnished one (75, 102).
- f) At eIII (Lambert 1972, 855–856, figs 13, 15), skulls 6 and 8 were found close to fragments from a flat-based and a rim-perforated basin, and a deep jar body wall (144, 211, 212).
- g) At dIV (Lambert 1972, 856, fig. 14), skull 7 was found with fragments from plain polished and slipped vases, including some black and grey (129), a possible painted (133), as well as a jar with relief decoration (174, 176), illustrated by Lambert (1972, 870, pl. xi) as a single fragment, but today surviving in three joining pieces.
- h) A special case was square dIII, where the most skeletal finds, including six almost whole skulls (nos 9–14), were revealed (Lambert 1972, 852 and 857–858, figs 7 and 16–19). Fortunately Perlès preserves a detailed account of this context in her diary. According to her report skull 11 was placed inside the wide base of a plain polished container (146) as depicted in a photo published by Lambert (1972, 857, fig. 17). She described that when the team lifted the skull from the container, a green polished stone ax was found in the bottom of the pot. Perlès illustrated the ax in her notebook, which has helped us identify it as no. 36 in the catalogue published by Papathanasopoulos (2011, 99). Perlès also notes the presence of charcoal inside the pot, and the central position of the pot/skull in the context, although with some caution as to possible taphonomic bias.
- i) At cIII small scattered post-cranial remains have been recorded, without any skulls, along with several fragments of vessels: a banded jar, a coarse base with evidence of interior use wear, a body sherd attesting to possible interior cooking use, a mottled polished bowl (91, 145, 147, 210), and many plain body fragments. Some very local aggregations of clay were observed in areas dIII and cIII.

Other than pottery, Lambert (1972, 860) recorded that Ossuary II also yielded a single chipped obsidian piece, and a small assemblage of food remains (sheep and cattle bones, and a few shells), but no stone or bone artifacts nor jewellery. She also mentions three small metal fragments, but without being more specific. Papathanasopoulos (2011, 104–105 nos 45–47) also refers to a number of iron-rich ground stones from Ossuary II.

The above excavation reports suggest that the funerary fill of Ossuary II resulted from a single episode, rather than resulting from successive reburial events, on account of the specifically prepared floor and the covering fill.

The 1971 material has been stored since that time in wooden boxes, preserving also the wooden tags and hand-written paper data forms from the period. Θ 9 and Θ 10 were again surveyed in 1986, and a large collection of pottery fragments was gathered from the exposed surface of the old trench, which would stratigraphically correspond to the lower fill of 1971 excavation (Table 5.4). The 1986 finds have been marked with the recovery date and location data on their reverse side.

Individual stories in a pre-fragmentation context

Cultural placement and theoretical re-approach

I have counted 306 pottery fragments from Ossuary II dating to the FN (Tables 5.5–9; Appendix 5.1), on the basis of shape and surface morphology such as prevailing red homogeneous colours, rough surfaces, wide oval and shallow profiles, perforated rims, short curved handles, as well as variable banded ornaments; all of these characteristics are typical, with some extending to the later FN stages as well. The users of Ossuary II preferred large capacity vessels, ranging from the earthenware coarse basins, the deep and wide bowls and the deep, upright banded-jars. Painted pottery is not securely confirmed at present. Only a small proportion of the fragments comes from thin-walled polished vessels which may be grey or black.

On the grounds of the very homogeneous contextual deposit in Ossuary II, its relative cultural positioning should be placed at the end of the 5th millennium BC. Absence of strong late FN features (*e.g.*, rolled rims) would exclude any activity of the 4th millennium BC. Radiocarbon dating of skulls 4, 5 and 7, as well as two more bone samples, with results in the last couple of

centuries of the 5th millennium (Karkanas, this volume), has confirmed the relative chronology.

The cave was extensively and constantly populated at the time, as is suggested by the vast comparable assemblages from the entrance, Chamber B/North Sector and location Θ 27 at least. The last set continues on further, beyond the 5th/4th millennium divide, down even to the end of the FN. Phelps (2004, 117) indeed first made this point when he examined some coarse pottery from the cave in the 1970s: his chronological comparisons are still very valuable today. The outside ‘acropolis’ assemblage from Site 2: Ksagounaki (Pullen *et al.* this volume) is also from an advanced FN site, partly overlapping in time with Ossuary II, confirming that many people were in the vicinity of the cave at that time. The same potters, whose products sometime ended up in Ossuary II, may have also provided the bowls, basins, banded-jars, red coarse and mottled pots to the contemporary domestic establishments in the adjoining Chamber B/North Sector (Katsipanou, this volume; Valvis, this volume), as implied by a wide range of comparable individual attributes.

In a wider geographical context, communities using Alepotrypa Cave form part of a densely populated Laconian landscape: one farmed, herded, and settled by intercommunicating open-air settlements (Waterhouse and Hope Simpson 1960, 1961; Crouwel 2009; Cavanagh and Mee 1998; Mee 2009b, Cavanagh *et al.* 2004), and also by more cave sites (Koumouzelis 1989; Kaznesi and Katsarou 1999–2001; Efstathiou-Manolakou 2009, fig. 2.1). Although FN potting traditions and functions attested in Ossuary II may have been widespread across many other locations both inside the cave and outside in Laconia, as well as beyond in other contemporary mainland sites, I find it more insightful to focus on how this culture was assimilated during the short-lived and small-scale use of Ossuary II, rather than to dwell on technical cultural comparisons with the other sites.

Given the cultural and contextual coherence of the fill, I have assumed that the ceramic fragments found in Ossuary II originated from containers that were produced and circulated within a short period of time, maybe within only a few generations of potters and users. Their deposition in Ossuary II, however, was only the last scene of the play. Before that event, any pot could have had a short or long lifetime, from the moment when the potter hand-built it, other people used it, and before it, much overused and worn, either ended up in fragments, some

Table 5.4. Number of the Ossuary II pottery fragments per section and year of research

	1971	1986	Other year	Total
cIII	21	–	–	21
dIII	45	–	–	45
dIII–dIV	4	–	–	4
dIV	10	–	2	12
eIII	5	–	–	5
eIV	4	–	–	4
fIII	27	–	–	27
fIV	1	–	–	1
gII	3	–	–	3
gIII	1	–	–	1
No info	–	177	6	183
Total	121	177	8	306

Table 5.5. Number of pottery fragments per section and surface group

	cIII	dIII	dIII–dIV	dIV	eIII	eIV	fIII	fIV	gII	gIII	No info	Total
Plain monochromes	11	21	2	6	3	3	12	–	2	–	73	133
Plain coarse basins	–	7	–	1	2	–	1	–	–	1	10	22
Polished monochromes	8	9	–	1	–	–	6	–	–	–	66	90
Banded jars	1	2	2	1	–	1	1	–	1	–	19	28
Grey/black burnished monochromes	1	6	–	3	–	–	7	1	–	–	15	33
Total	21	45	4	12	5	4	27	1	3	1	183	306

of which were picked up to be thrown to the Ossuary, or before it was intentionally fragmented *to be* deposited in the Ossuary. Moving between the large-timescale of the FN culture and the short-scale one for any single pot's existence, or more accurately any single potsherd's, would necessitate locating within the big, immobile window of the standardised FN time and styles of Alepotrypa, the very many smaller windows of individuals who made things happen and change, acting in real life and time. Eventually, all these personal trajectories fuse in the social mortuary project implemented in Ossuary II.

Ware groups and vessel shapes

Plain monochromes (buff to black)

(Figure 5.3; CPII 4)

Potters produced most of these handmade vessels by coil building (143, 213) and pinching up (145, 299), with the

paddle and anvil also attested in Ossuary I (see above). They would also add extra layers inside or out to increase and strengthen the base (214 and 370); once (74) the potter added an extra layer of clay on the underside of the initial base to raise it higher. They would similarly reinforce the handle attachments with extra clay pressed and smeared around their roots.

Potters then gave the vessel a very rudimentary smoothing, as is seen from these fragments, leaving the porous surface of the pot exposed. Traces of brush marks from this practice are visible on some surfaces (141, 145).

On the rare occasions that they applied some slip, they would generally leave it unpolished. More particularly, if the potter chose to slip only one surface of the pot, this would more usually be the interior, which preference may indicate some functional priority. Even so, the open containers that received a slip still represent a very low percentage of the total present in Ossuary II. Contrary to

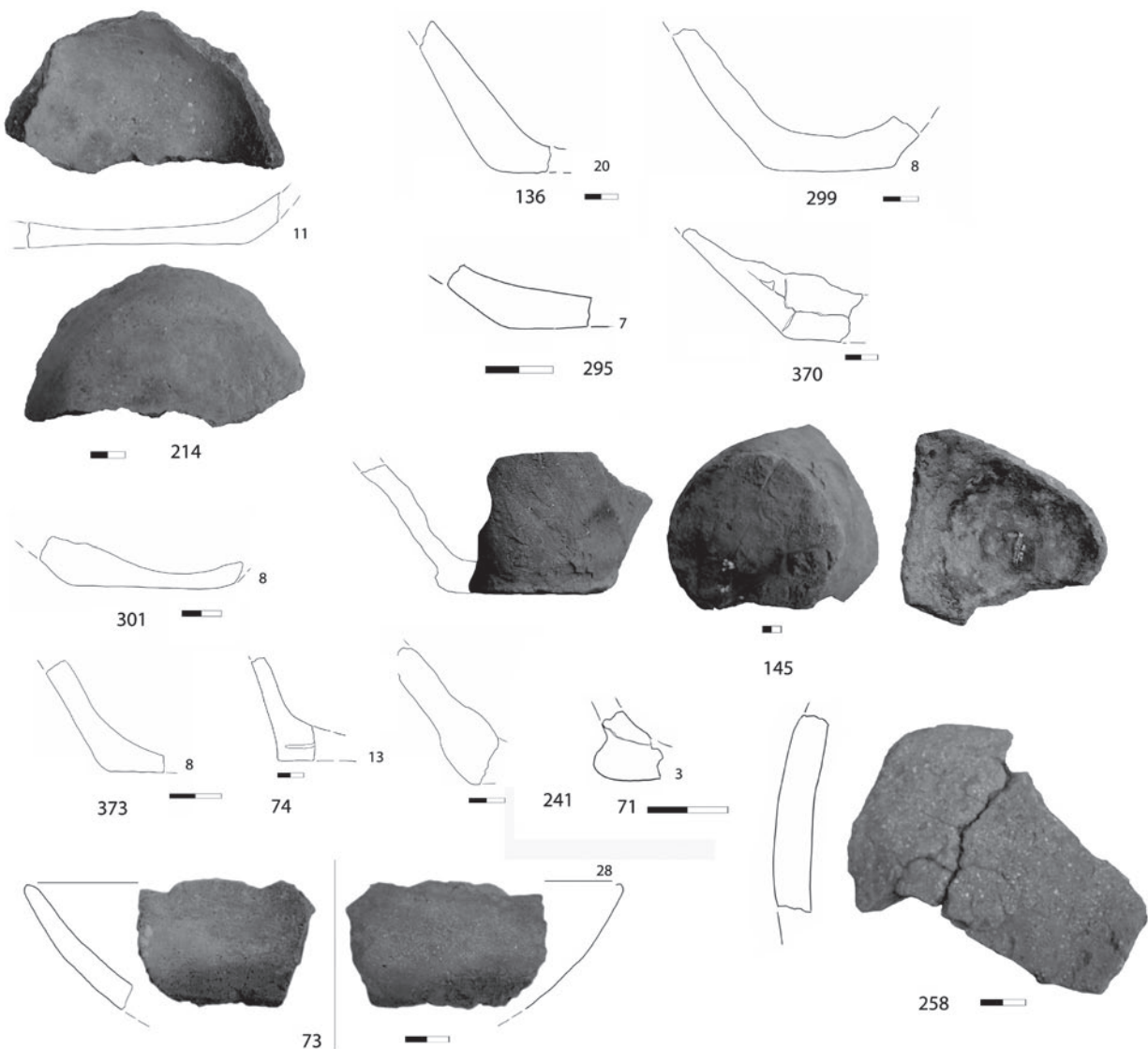


Figure 5.3. Ossuary II. Plain monochrome ware (by Anastasia Tzalla and Stella Katsarou).

Table 5.6. Number of pottery fragments per section and vessel shape

	cIII	dIII	dIII–dIV	dIV	eIII	eIV	fIII	fIV	gII	gIII	No info	Total
Bowl vertical	–	3	–	–	1	–	1	–	–	–	10	14
Vertical Asymmetrical	–	2	–	–	–	–	–	–	–	–	1	3
Bowl convex	1	3	–	–	–	–	3	–	1	1	6	15
Bowl rimmed/necked	–	–	–	–	1	–	–	–	–	–	6	7
Bowl convex /Asymmetrical, shallow	–	1	–	–	–	–	–	–	–	–	–	1
Bowl concave	–	3	–	–	–	–	1	1	–	–	4	9
Bowl spherical	–	–	–	–	–	–	–	–	–	–	6	6
Bowl carinated	1	1	–	–	–	–	1	–	–	–	2	5
Bowl converging	–	–	–	–	–	–	–	–	–	–	1	1
Bowls (other)	4	16	3	2	1	2	8	–	1	–	53	90
Jar concave	–	1	–	1	–	–	1	–	–	–	7	10
Jar vertical	–	–	–	–	–	1	–	–	–	–	2	3
Jar necked	–	1	–	–	–	–	–	–	–	–	4	5
Jars (other)	4	3	–	3	1	–	4	–	–	–	28	43
Other vessels	11	11	1	6	1	1	8	–	1	–	54	94
Total	21	45	4	12	5	4	27	1	3	1	183	306

what one might have expected, potters did not seem to be much concerned about leaving the functional interior surfaces rough and porous, a feature also prevailing at other sites (Cavanagh *et al.* 2002, 587; 2004, 91; Perlès and Vitelli 1999, 99; Mavridis and Sørensen 2006, 125).

In the pit-firing process, the potters managed to regulate the oxidising conditions in such a way as to achieve uniformly monochrome surfaces, mainly varying in colour from light red through orange to a light brown, more rarely a buff to dark brown, light grey towards black. The red–brown colour range was also effected homogeneously inside and out and also at the core, or at least with but minimal difference. Cases do of course occur when the pit-firing achieved only incomplete oxidising conditions, resulting in a darker core (136, 194, 256). A few instances exist of slipped vessels fired black or grey on the interior, whilst having a brown or red exterior (136, 194). The potters were also able to achieve well-contrasted colours on the two surfaces (in and out) by regulating the oxidising flow to the interior surface, probably by careful placement of the pot inside the firing pit. Some vessels had acquired grey clouds on their monochrome surface, or even black clouds inside a paler outline (136, 145, 184, 202). More seldom do red clouds appear on the vessel's light brown surface after firing (100, 204), or indeed the opposite (169), presumably as a result of localised micro-conditions within the pit.

In terms of shape, potters produced some small and medium-sized bowls and a few jars. Their profiles may be detailed as follows:

1. Convex bowl, with everted to vertical walls, ending in a plain rim; 21–30 cm wide (102, 141, 235, 254, 255).
2. Conical, low-rimmed bowl, protruding ledge-rim defined by incision on the outside (213).
3. Vertical or inverted-walled bowls, ending to variously protruding rim-forms (307, 349).
4. Concave bowl bearing plastic decoration or a T-lug (106).
5. Concave bowl (257, 350, 359).
6. Shallow thin-walled conical bowl, ending in low-everted rim (169).
7. Shallow thick-walled elongated bowl (184).
8. Wide and flat-based vertical-walled bowl (100).
9. Spherical bowl, with vertical handle (256).
10. Concave jar (202).
11. Deep or medium-deep necked jar (72, 201), around 15–17 cm wide.
12. Deep or medium-deep narrow-necked jar, untreated inside (79, 194), with the possible exception of the interior rim area (197).
13. Deep vertical-walled and narrow-mouthed jar, blackened inside possibly due to cooking function (147).
14. Flat coarse bases (136, 214, 295, 299, 301, 370, 373), with an average diameter of 12 cm. Fragment 145 from irregular, wide and oval, flat bottom, preserving straw or wood marks on the underside.
15. Raised flat bases from an open bowl (74) or a deep jar (241).
16. Small ring base, only 3 cm wide (71).

There are two fragments of uncertain date, though yet within EN. The hemispherical bowl (73) was fired so as to acquire a range of colours that gradually change on the interior – white, red and grey. This measured sequence of colours would normally be assigned to the ‘rainbow firing’ category of the EN period, although it is here possible that post-depositional alteration may be responsible. A rim and body fragment (258) belong to the deformed profile of a bowl: an early date is suggested first by the dense presence of limestone inclusions and then by the severe weathering of its edges, which are considerably worse than the rest of the ceramic record from Ossuary II.

Plain earthenware coarse basins and ‘cheese-pots’ (Figures 5.4 and 5)

In terms of classification, this is a Plain Monochrome sub-category. The potters manufactured both rim-perforated

Table 5.7. Number of pottery fragments per class and vessel shape

Shape	Plain monochromes	Plain coarse basins	Polished monochromes	Banded Jars	Grey/black burnished monochromes	Total
Bowl vertical	2	11	1	1	–	15
Vertical asymmetrical	–	3	–	–	–	3
Bowl convex	7	2	6	–	–	15
Bowl rimmed/necked	3	2	2	–	–	7
Bowl convex/Asymmetrical shallow	1	–	–	–	–	1
Bowl concave	3	–	4	–	2	9
Bowl spherical	–	1	4	1	–	6
Bowl carinated	–	–	2	–	3	5
Bowl converging	–	1	–	–	–	1
Bowls (other)	26	1	33	13	18	91
Jar concave	1	–	3	3	–	7
Jar vertical	–	–	1	2	–	3
Jar necked	3	–	2	–	–	5
Jars (other)	6	–	27	4	9	46
Other vessels	81	1	5	4	1	92
Total	133	22	90	28	33	306

and impressed-rim basins and bowls, with the same very rough, non-slipped and red-coloured surface.

Judging from fragments coming from vertical walls with a sharp angle at the coarse flat base (144, 179), we can probably safely reconstruct the profile of these vessels as a flat-based shallow pan with upright body walls, and an oval or very elongated form. Potters would mostly manufacture the flat base out of a clay slab, and would then attach the walls to it, pinching or patting the base onto the slab-like side-pieces made from another lump of clay. Straw, grass or wood-grain marks all over the exterior surface may show how the side-slabs were formed, set aside on such materials for convenience of handling or to allow the sticky clay to dry somewhat; or even imply they were wiped with grass after formation. The base usually contains clay lumps that have not been smoothed out. Similarly the extra clay applied to strengthen the body-base join is left unsmoothed. The potter of basin 76 has partly pierced the underside of the base with a hole, probably on purpose to facilitate the firing of the core.

The material from Ossuary II demonstrates numerous individual morphological properties, or quirks. Thus, the potter of basin 244 has set the vertical walls slightly inside the edge of the base slab, making a footed profile. All the basins 144, 177, 178 and 179 have been formed alike, maybe by the same potter: the edge of the base slab has been slightly turned up and then the thick upright walls have been attached to its outside, without a thought given to concealing the visible junction. Today we can tell how the vessel was built by tracing this visible joint on the underside of the pot. On the interior they would generally slightly smear over and so hide the junction (243, 244); but the potter of 177 disdained even this, leaving the junction visible inside and out.

The line of the rim of these basins is not very even. We can also observe variety in such features as the angle of

the wall and its thickness, let alone the rim profile. Thus the potter of convex bowl 154 gave it thick walls that thin to the rim, while deep bowl 205 had a more spherical body contracting in its upper part. The deep bowls 212 and 206 (Figure 5.8) are made with an outcurving rim. The deep shoulder-handled jar 174 is a ‘one-off’ in terms of its more closed profile and handle, which the potter has enhanced with perforations and impressions on the lip. Fragment 283 comes from a rim-perforated coarse vessel with a lower wall at the rear of the vessel, giving it the look of some hybrid involving a scoop. Some of the perforated rim fragments may also belong to such vessels, unless they come from deep or medium bowls (80, 140, 154, 203, 205). The potters also manufactured a rounder and rim-perforated bowl of the FN ‘cheese-pot’ type, *i.e.*, with thinner-walls and a shallower body, and with fewer and smaller holes along the rim (198).

In terms of their manufacturing techniques, these bowls are made from coiled or pinched-up clay; they always display a careless approach to their modification. Whoever pinched up and thinned the body walls of bowl 140 left a visible palm print on the interior. The outcurving rims and necks were pulled up from the body-fabric and scraped on the inner surface (174, 212, 280; also Figure 5.8, 206). The potter has heavily and carelessly scraped the vertical wall of bowl 80, leaving behind local indentations. Only one lower body fragment probably shows traces of the paddle and anvil technique (107).

Potters were willing to perforate the rims of these vessels, punching holes even in close proximity. But it was not an unbending rule. The perforations were made when the pot was still wet: the holes came in varying sizes, shapes and numbers along the rim. Container 80 had its holes opened wider by applying the tool from both sides. For 140 and 154 however the potter used a very thin piece of reed which hardly pierced the wall of the rim, so that many holes have closed up on themselves

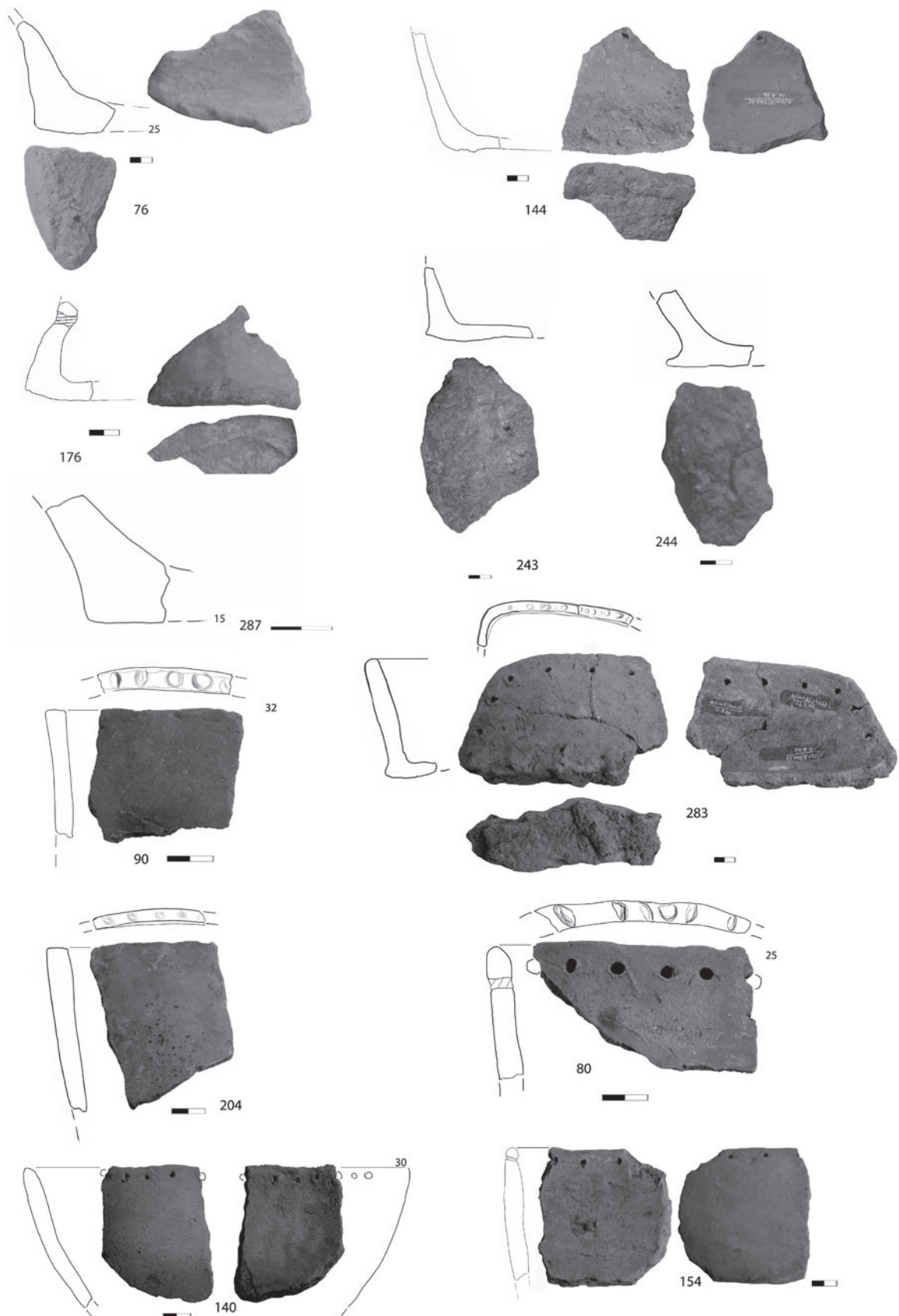


Figure 5.4. Ossuary II. Plain basins and 'cheese-pots' (by Anastasia Tzalla and Stella Katsarou).

again. Displaced clay can show from which side the potter worked, when making the hole.

Many arguments have been proposed to explain why the potters required a perforated rim; however all of them are speculative. As the basins usually show no evidence as to their use on a cooking fire, the fastening of a protective mat wrapping around the vessel's body would be likely, especially given the low-fired and thus fragile condition of the wide basins (cf. Sampson 1987, fig. 68c). On the other hand, the holes of some pots are so minute that they could barely serve any function. The particularly wide hole on body fragment 183 varies so significantly in terms of size and treatment from the normal run that it probably indicates that the potter had intended this one for a different function.

Potters would use their fingers on the top of the rim to make impressions. Usually they go together with the perforations, but a few impressed but unperforated bowls do exist (90, 204). Impressions may be thickly spaced and hemispherical (80, 174) or wider to oval (205) in shape; but often they are so shallow that today they may only be detected by touch and raking light. There is one case where the potter incised the rim with the fingernail (280).

Looking at the aesthetics of these vessels with a modern eye, it is somewhat surprising that the Neolithic craftsmen had no particular concern about the surface of these basins beyond the forming stage. Potters would not slip the surface, nor even smooth it, and thought nothing of leaving visible palm or scrape marks (76, 80, 140) from the forming processes. On the other hand they were consistent in elaborating the rim by finger-impressing. Possibly they viewed the perforated holes as being as much decorative as functional, perhaps even at times purely the former.

Earthenware basins and bowls were fired bright red inside and out and through the core, evidently testifying to well-achieved oxidising conditions in the firing pit. Only very few exceptions exist that indicate a reduction atmosphere from their core colouring (205) or surface clouds (80, 144, 177, 179, 280).

Profiles of this group from Ossuary II range as follows:

1. Coarse basin with low vertical walls set on a flat base (76, 144, 179, 243, 244, 287). Potters made very wide basins of this sort, starting from a minimum 25–27 cm diameter up to possibly double the size.
2. Oval, vertical-walled basin, cut away at the reverse to make the form of a scoop (283).
3. Deep and broad pot, with vertical walls ending in a plain impressed rim, but not perforated (90, 204).
4. Rim-perforated convex bowl (80, 140, 154, 203).
5. Rim-perforated inverted jar (205).
6. Rim-perforated convex bowl of thinner body, or 'cheese-pot' (198, 371).
7. Concave-rimmed bowl, perforated at the curve (212, 280).

8. Rim-perforated and rim-impressed concave neck, from the shoulder region of a handled jar (174).

9. Flat and wide bases (177, 178).

Taking a broader view may be a useful way to avoid the trap of comparativism and superficial thinking about Ossuary II: it constitutes an outstanding assemblage in contrast to the generally fragmentary record known from other mainland sites. Alepotrypa shared similar traditions with Neolithic communities over a wide geographical area both in the southern Greek mainland and the islands as far as the east and northeast Aegean (Doukaki 2009). Mainland contexts in particular – such as Kouveleiki Cave B at Geraki (Kaznesi and Katsarou 1999–2001, fig. 2), Kouphovouno (Cavanagh *et al.* 2004, 91–92, fig. 21.13), Franchthi Cave (Vitelli 1999, 78, figs 58C, 81, 83), Lerna (Vitelli 2007, CD photos 76–77), Ayioryitika (Petrakis 2002, fig. 33.142), Asea (Holmberg 1944, 55–56, fig. 57c), Klenia (Phelps 2004, 114), the Kastria Cave (Katsarou and Sampson 1997, 321–328), the Athenian Agora (Immerwahr 1971, pls 12–13 and 69), Sarakenos Cave (Sampson 2008, 188–189, figs 103–104; cf. no holes, figs 134.98, 139), Skoteini Cave (Sampson 1993, figs 187–188), Proskynas Fthiotidas (Psimogiannou 2008, pls 4.34–35), and Kephala (Coleman 1977, pl. 37) – share most of their typical features with the material from Ossuary II.

One may compare the scoop hybrid with other such idiosyncratic containers, *e.g.*, a large pot from Lerna, called a 'drum' (Vitelli 2007, CD photos 71–74), a boat-like shallow vessel from Yali (Sampson 1988, table 8.3), and yet more comparanda, perforated or otherwise, that have recently become known from various FN sites in Attica (Palaialogos and Stefanopoulou, *in press*). This exercise is valuable in that it bears witness to the multiple contexts and singularities of these pieces, be that from an individual or communal perspective. The persistence of the perforated baking pan from the LN through to EBA I may not indicate so much that these containers were so popular as to survive such a long time span, but rather that the shape was adequately flexible to adapt to different local and temporal trajectories. Or, perhaps more accurately, that people were always updating these vessels to meet contemporary needs.

Polished monochromes (buff, red-brown and black) (Figures 5.6 and 7)

Alongside the rough-surfaced containers, potters did slip some vessels with a thick coating, and even polished a few of them, although not intensely. They slipped many on both surfaces, more than half of the pieces recorded falling into this category. They then fired them to a buff and red colour, but also to black – generally this ware is more often found in darker colours than the non-polished vessels. We can observe however that the cores of these dark-fired pots are mostly oxidised (although 25 fragments

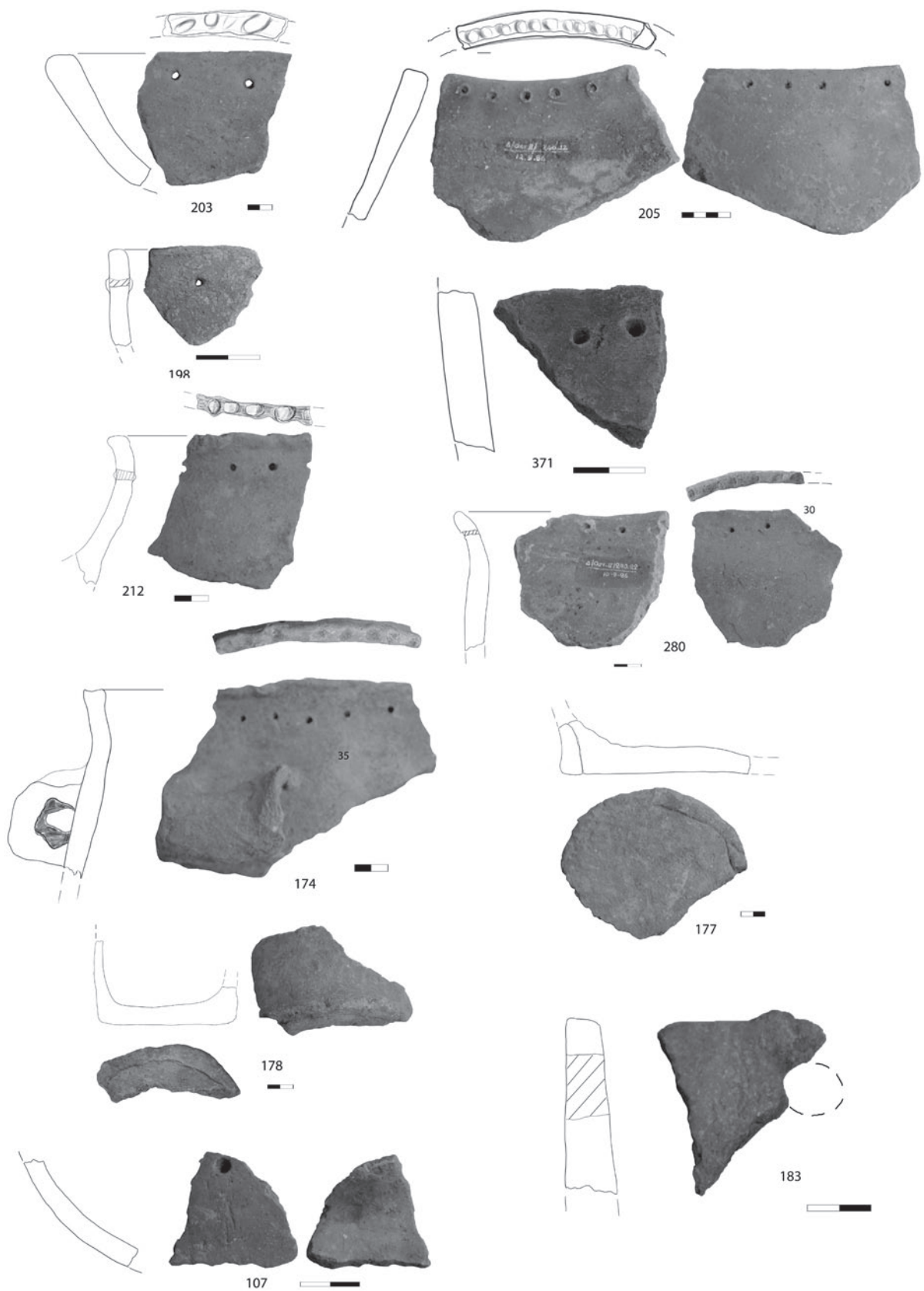


Figure 5.5. Ossuary II. Plain basins and 'cheese-pots' (by Anastasia Tzalla and Stella Katsarou).

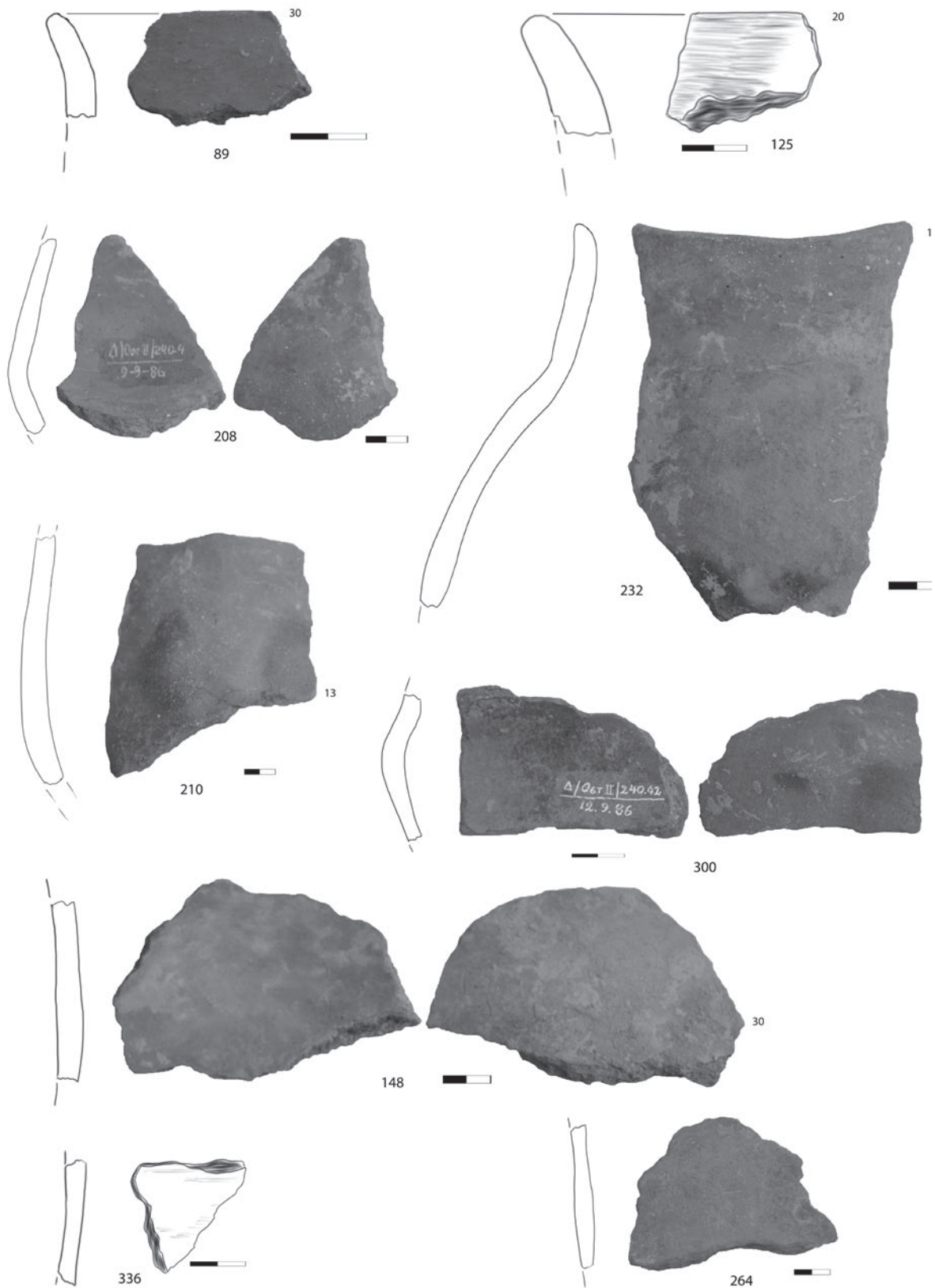


Figure 5.6. Ossuary II. Polished monochrome ware (by Anastasia Tzalla and Stella Katsarou).

Table 5.8. Number of pottery fragments per surface colour and surface group

	Buff	Brown light	Red	Orange- red/brown	Red- brown	Brown	Brown- grey/black	Grey	Grey- black	Black	Bicoloured	Total
Plain monochrome	3	20	40	3	10	47	2	5	1	1	1 (BUFF + R)	133
Plain coarse basins	–	–	2	2	2	14	–	2	–	–	–	22
Polished monochromes	1	12	20	2	13	32	4	1	1	3	1 (R + BRlg)	90
Banded jars	–	2	2	1	4	11	–	1	–	7	–	28
Grey/black Burnished Monochromes	–	–	–	–	–	–	1	7	2	20	3 (BR on GR/BL)	33
Total	4	34	64	8	29	104	7	16	4	31	5	306

do have a dark core). The firing was also executed to bring out contrasting colours between the two surfaces of the pot: a black interior contrasting with a brown-reddish exterior, or brown on the exterior and buff within, or dark brown out contrasting with an interior red.

Potters also manipulated the firing in such a way that the surface slip is a red colour against the underlying original grey background. In one instance (the carinated bowl 208) the interior surface displayed gradually separating rainbow colours.

Many of these slipped and polished pots are fired to a red mottled surface condition. The deep and spherical rimmed bowl (300) and the convex bowl (210), the handled one (199), and maybe also the spherical bowls (282 and 232) are all in a mottled grey, dark brown and black range of colours, so creating a colourful exterior surface which contrasts with the interior fired to a plain monochrome; in 199 the red-fired handle stands out against the grey-black mottled surrounding surface. The mottling is probably produced by the deliberate regulation of flame, smoke, temperature and oxygen on the carefully positioned pot inside the firing pit. The consistent manufacture of bowls and collar jars with red mottled surfaces may have been significant and deliberate, rather than occurring as a mere coincidence or a mistake. Mottled surfaces are different from the effect of random clouds, as seen on bases 146, 294, 369. Potters may have had some rationale as to why they would combine only certain profiles with this particular firing technique (cf. Urem-Kotsou 2006, 54).

Profile details of the repertoire are as follows:

1. Bowl with concave rim and thin, low walls (89, 125).
2. Carinated bowl (208).
3. High-collared, deep spherical bowl (232).
4. Deep and open spherical bowl (210).
5. Rimmed, deep and open spherical bowl (300).
6. Concave bowl (148, 264, 336).
7. Narrow-collared jar, rimmed (289). Normal neck diameter range would be 9–12 cm.
8. Spherical bowl carrying a vertical handle (199, 200, 282) or a small horizontal lug (195).
9. Handled, deep vertical bowl (298).
10. Flat bases (146, 294, 369), approximately 9–12 cm wide.

Mottled firing gives an example of how the reconfiguring of old values may build new morphologies. It may in fact owe its existence to cloud-firing mistakes in everyday firing practice, which became canonised when someone developed a new fashion out of this aspect of an established technique. Instead of indicating incompetence and failure, mottled firing become elaborated and skilfully manipulated within the Neolithic community of potters and sought after by the users. Considered now as colourful and decorative rather than despised, it might have rivalled or even substituted for painted pottery. Although we will surely never find out which workshop and potter in Attica, central Greece or the Peloponnese was the first to experiment in this area, yet probably mottled pottery was so ‘invented’, as potters began to make trials, searching out silver linings in older technological clouds. Whole new local approaches may in fact emerge out of just one stimulating moment, and then expand very fast within the closely connected mainland Neolithic populations.

Jars with banded decoration (Figures 5.8 and 9)

Potters would sometimes add banded or incised decoration to some of the plain and the polished monochrome bowls that ended up in Ossuary II, also too on some of the rough earthenware bowls. The assemblage classified here is grouped together by this feature (see also Valvis, this volume). Potters use the same building techniques as elsewhere, that is, coil-forming (149, 239) and pinching up (206), but there also exist some slab-built vessels such as the deep banded-bowl 285. In this last the craftsman attached pre-formed clay slabs, possibly already sundried (we can tell this from its texture, hardness, and rounded finish), using a fresh layer of smeared clay as a ‘glue’. This use of the dried slab in forming the vessel was probably intended to secure the stability of the deep and sizeable pot. The slabs would then be smeared over or coated by layers of fresh clay.

Potters did not take much care of the surface beyond applying some rough and rudimentary smoothing before they applied the plastic bands. They would use brushes to smooth off the work marks, sometimes after they had applied the band to the pot; the craftsman of jar 104 brushed the pot vertically on the outside, stopping just short of a horizontal rope band. Banded pots were fired to a

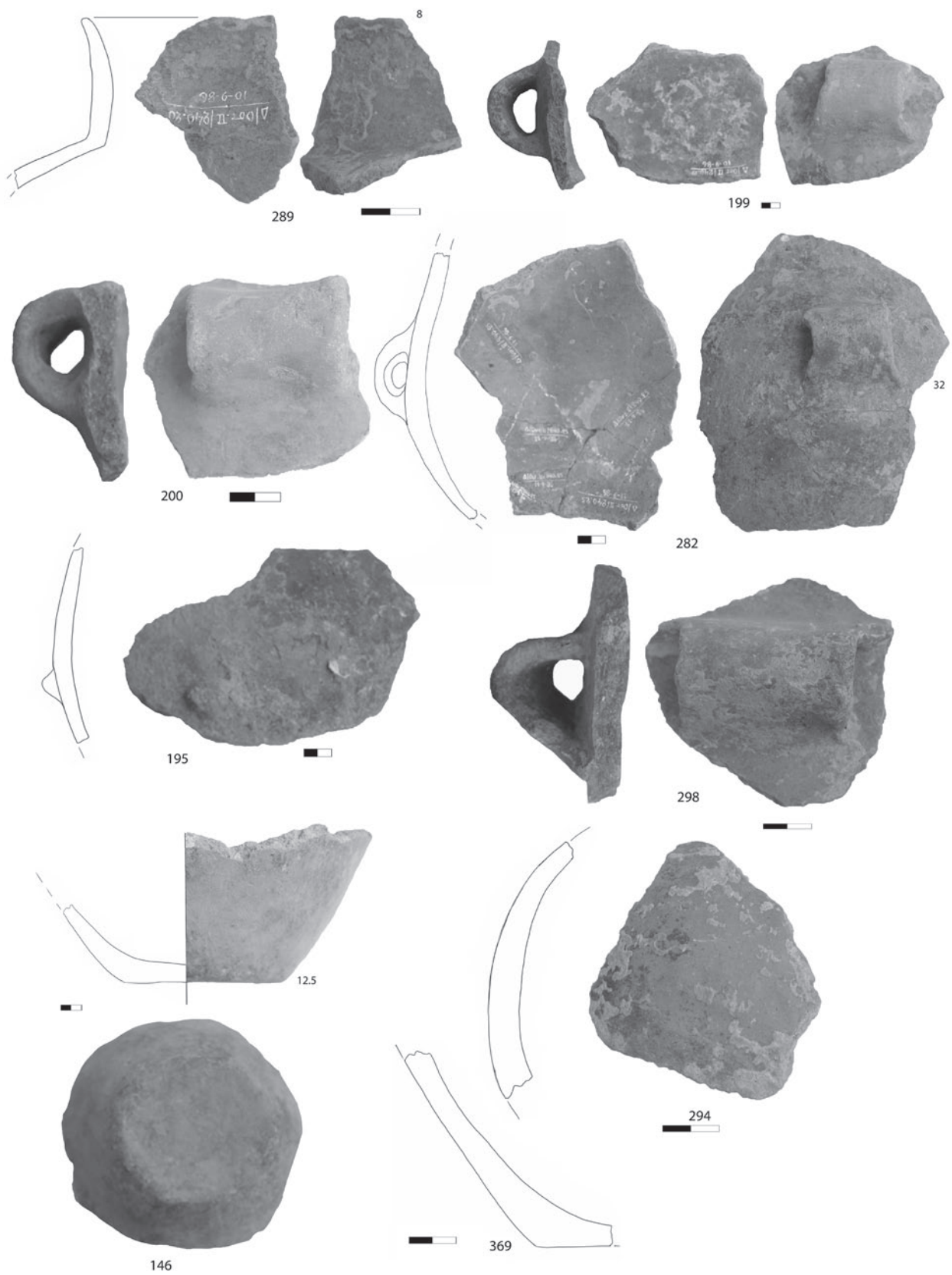


Figure 5.7. Ossuary II. Polished monochrome ware (by Anastasia Tzalla and Stella Katsarou).

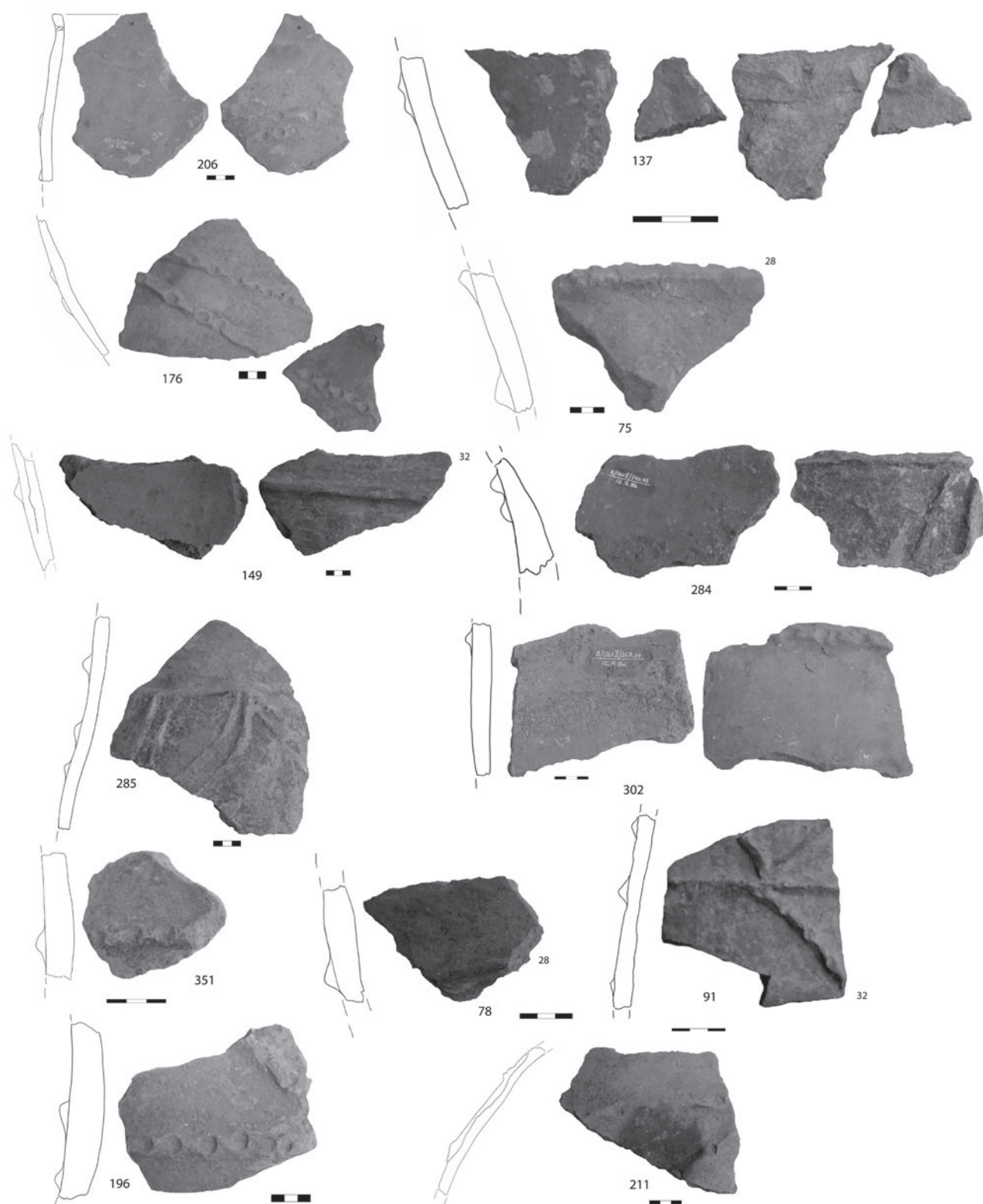


Figure 5.8. Ossuary II. Jars with banded decoration (by Anastasia Tzalla and Stella Katsarou).

dark red or brown colour (78, 149, 284, 285, 351). Slip and polish are also usually encountered on the interior, which may end up a markedly contrasting colour compared to the exterior surface (137–138, 149, 284, 285, 351). The

oxidising atmosphere usually reaches the core (242), while rarely do firing clouds mottle the surface (193, 211).

The potters formed the bands out of thin strips of clay, and stuck them on the vessel while it was still adequately

moist, to minimise the difference in the shrinkage of the two components. They would probably also smear over the thin surface cracks that could appear around the attachment area. In terms of the band's profile, they did not seem to seek a standardised appearance, but would rather play with their height, relief or angularity, which may vary even along the same band.

They chose to make bands triangular in section, when they intended to leave them plain (16 fragments) or decorate them with thin-cut incisions. They might incise one band along its entire length (75) or only one part of it (149). Sometimes, though, they would go for wider, more curved and thicker bands if they had a mind to make impressions on them. One potter left a wide, curved and low-relief band plain on his deep bowl (233). The roped band on the deep convex bowl 176 ends with almost no relief visible, maybe squashed flat under the pressure of a finger. However there are certain cases when the applied band has no particular relief at all, and finger-impressions have been made randomly on the rough surface of the pot (137–138, 193, 206).

The potters would often decorate the bands with finger-impressions (round or oval) to look like rope. In many other instances they would just use a tool to create all sorts of mark, such as the diamond-like impressions on the vertical jar 351, or even vertical scratches.

Craftsmen would arrange their plastic bands in various combinations on the jars and deep bowls, vessels mostly of some size and voluminous enough to carry a rich spread of patterns. Placing multiple and various diagonal bands across each other or with a central horizontal band on the pot (91, 192) was very popular. Usually there was a preference for combining plain with incised or impressed bands, or many variations of impressed bands on the same pot, rather than sticking to a well-executed, standard pattern. We can thus observe wide cuts on the band running alongside a typical rope-like band, on deep concave jar 196; a roughly incised band running parallel to a well made wide strip featuring oblique long oval impressions by a tool on a deep pithoid fragment 192. The body fragments displaying horizontal (75, 78, 87, 104, 176, 238, 242, 302, 351), diagonal (234 Figure 5.9; 236) or crossing (137–138, 237) bands, both plain and finger-impressed, probably come from complex decorative work. The potter might use applied bands to create a framed decoration zone, as on deep broad spherical bowl 285, and put three pairs of curved ribs pendant from the top horizontal band inside the frame. A similar arrangement may have occurred on the deep and broad, concave pithoid-vase 284. No doubt the potters fashioned many more elaborate and particular combinations which have not survived to the present. In several cases (238, 239, 240) it was the bad post-depositional weathering that ensured the disappearance of the applied bands.

Banded vessels of Ossuary II are of a deep and wide, vertical profile, as well as convex or concave in outline; they are detailed as follows:

1. Deep convex bowl bearing perforations along the off-set rim (206) (also cited under the repertoire of the perforated bowls).
2. Deep spherical bowl (137–138, 176).
3. Small broad-mouthed, vertical or concave jar (75, 149, 284, 285, 302, 351).
4. Small narrow-mouthed, vertical or concave jar (78, 91, 196, 211, 238).
5. Deep vertical bowl or small broad-mouthed, vertical or convex jar (191, 192, 193).

Potters find in banded decoration a creative opportunity to improvise, express individual aesthetics, and in a way express their own personalities. Close cultural comparisons between Alepotrypa and other Neolithic sites of all periods are very easy to establish. Indeed the list would be still very long, if one dealt with only the Laconian and the Peloponnesian assemblages: the Kouveleiki Caves A and B (Koumouzelis 1989, fig. 13; Kaznesi and Katsarou 1999–2001, fig. 4), Kastria (Katsarou and Sampson 1997, figs 212–221, pls 57–70, figs 61–64), the caves of the Mani and south Arcadia (Efstathiou-Manolakou 2009, 9, fig. 2.5), Agios Strategos (Waterhouse and Hope Simpson 1960, pl. 19a), Kouphovouno (Cavanagh *et al.* 2004, 91–92, fig. 21.14–15), Geraki (Crouwel 2009, 69, fig. 7.3), Ayios Dhimitrios (Zachos 2008, 57–59, fig. 26.39), Lerna (Vitelli 2007, CD photo 75), Ayioryitika (Petrakis 2002, figs 32.137, 33.139, 141, and 34.143–144), Asea (Holmberg 1944, 57, fig. 60a), Sphakouvouni (Syriopoulos 1964, 274–275, fig. 140), Kandela (Howell 1970, pls 28b, 29a, 34b), and Tsoungiza (Pullen 2011, 34, fig. 2.13:23). From outside the Peloponnese one could cite as typical cases: the Athenian Agora (Immerwahr 1971, pls 10–11), Sarakenos Cave (Sampson 2008, 229–234), Skoteini Cave (Sampson 1993, 158–159, pls 139–141, figs 164–165), Plakari (Cullen *et al.* 2013, 21–42), and Pangali, Aetolia (Mavridis and Sørensen 2006, 126–127).

Grey/black polished/burnished monochromes (Figure 5.10)

Some well-polished and burnished thin-walled vessels are represented in Ossuary II. Potters manufactured both small tableware bowls and deep containers in this quality ware. In terms of forming techniques, there are a couple of fragments attesting to coiling (70), and one fragment of a deep spherical bowl witnessing the paddle and anvil technique (175). The potters would fire these elaborate containers completely grey or black and lustrous. An examination of their sections indicates that, despite their reduced surface, the vessels had retained an oxidised core, showing that potters had begun the firing process with fresh and oxygenated air. Whether deliberately intended or not, the concave bowl 93 and the carinated cup 151 ended up with the black or grey colouring limited to their thin slip, the original surface and body however being contrastingly oxidised to red or a lighter colour. Potters

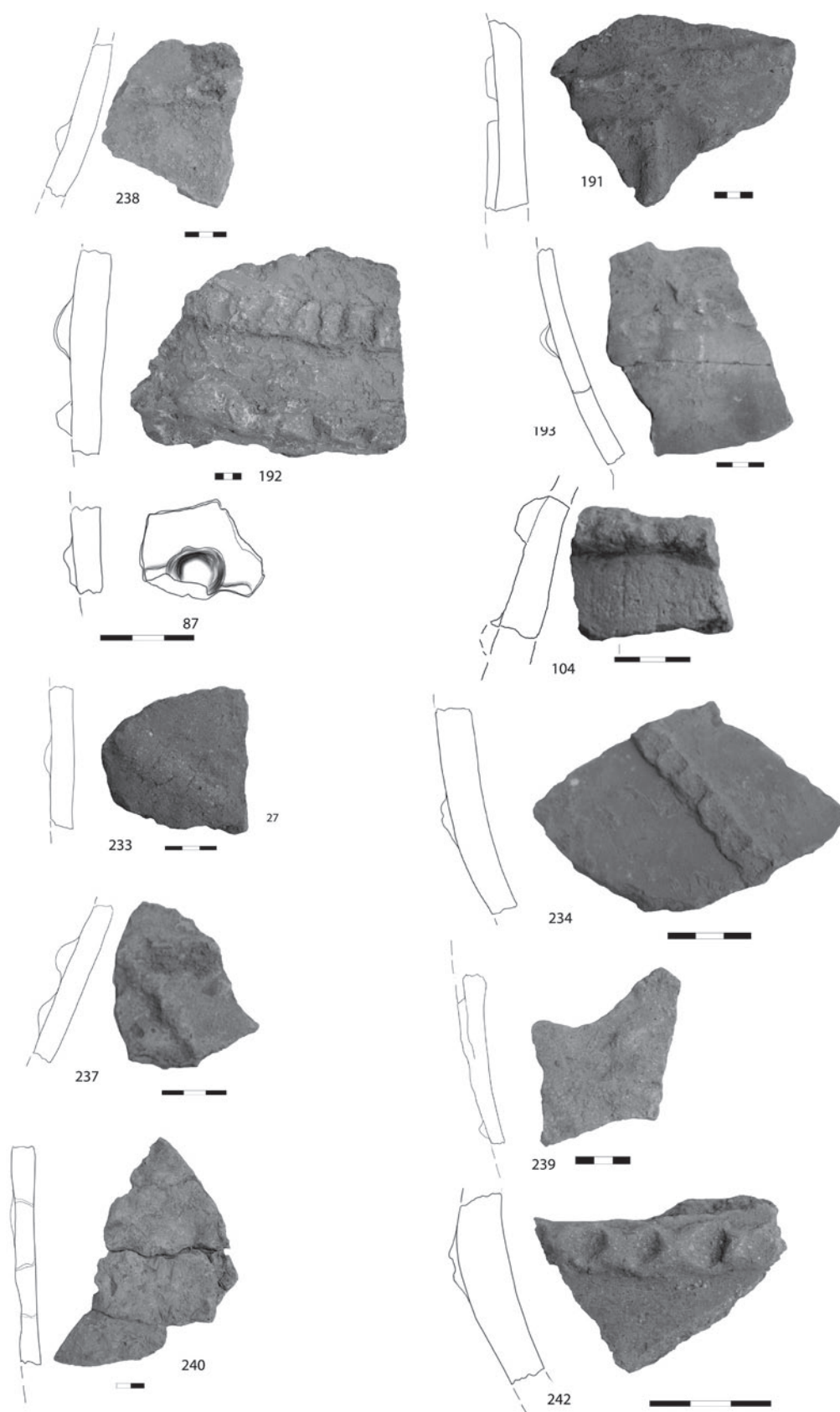


Figure 5.9. Ossuary II. Jars with banded decoration (by Anastasia Tzalla and Stella Katsarou).

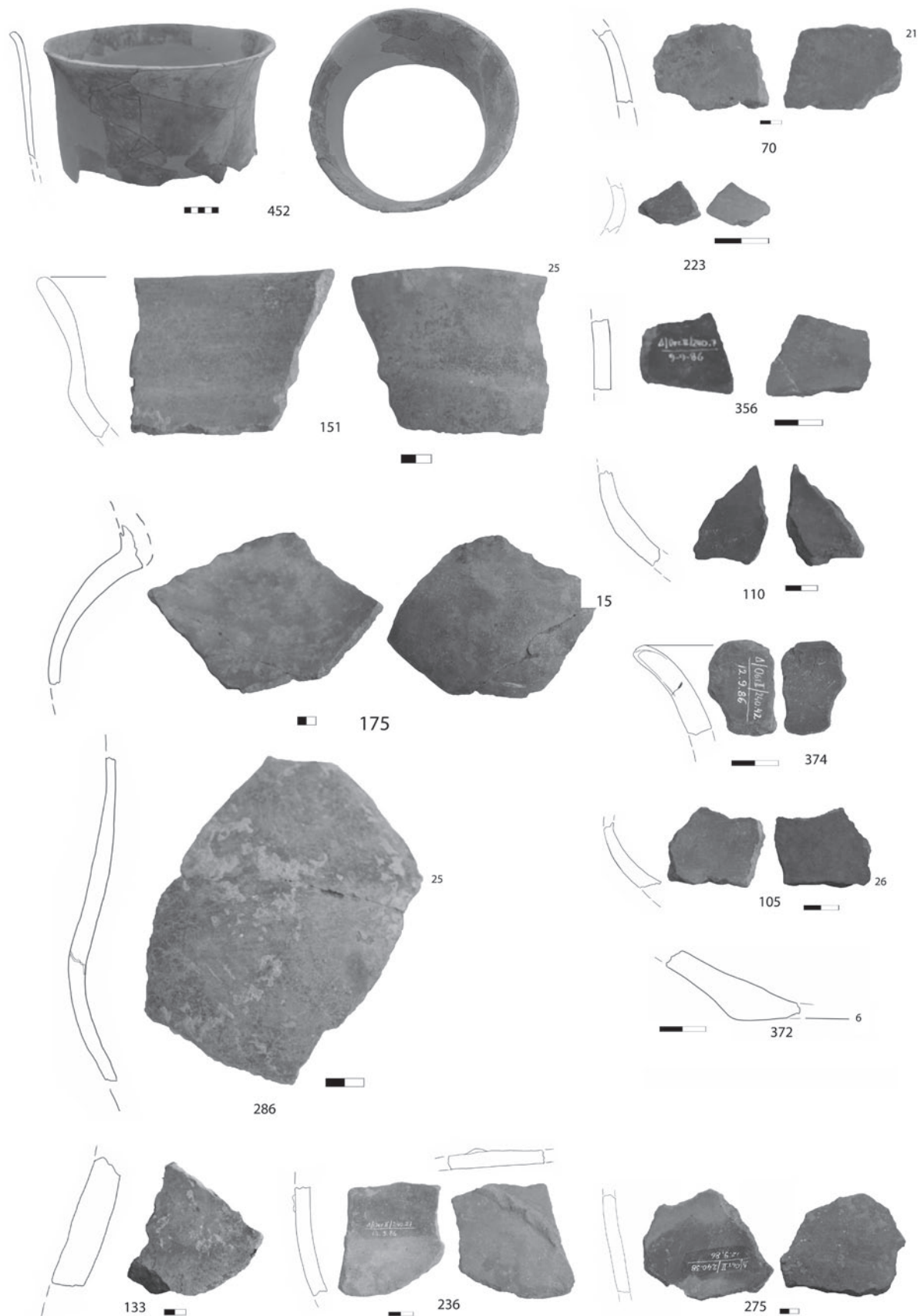


Figure 5.10. Ossuary II. Dark polished/burnished monochrome ware (by Anastasia Tzalla and Stella Katsarou).

fired the carinated bowl 223 so that it became black on the exterior, but grey on the interior, and the convex bowl 356 in the opposite way, while the ring vessel 452 is grey out and red in.

Bowls 105 and 110 have dark brown clouds spotting their black lustre, which may be due to some local variation of the reducing atmosphere inside the firing pit. However the grey colour on the deep rimmed-spherical bowl 175 is the result of a mottled firing rather than a fully reduced one, although the same pot was fired grey on the interior as well.

Potters did burnish these vessels very intensely, which left marks of their work visible. They may work in the same direction on both sides, *i.e.* horizontally both inside and outside of the convex bowl 105 and carinated cup 151, or they could vary their direction of burnishing to suit the constraints of the vase shape (70). This last effect is best seen on the large preserved surface of the big ring vessel 452.

Within the Ossuary II corpus, the dark-fired lustrous repertoire is made up as follows:

1. Ring vessel (452), thin-walled and concave, measuring 20 cm in preserved height and 40 cm at the rim diameter.
2. Concave bowl (70, 223, 356).
3. Flaring bowl (374), measuring 17 cm wide at the rim.
4. Slightly carinated bowl (110).
5. Deep spherical bowl, rimmed or collared (175).
6. Concave carinated cup (151).
7. Concave carinated bowl (286), described as piriform jar at Kouphouvouno (Mee 2009, fig. 10).
8. Convex bowl (105, 341).
9. Flat bases (372), measuring 12 cm wide.

The same quality of pottery is also recorded at LN/FN Kouphouvouno, as distinct from coarse wares (Cavanagh *et al.* 2002, 587). Vitelli (2007), however, would date the heavily dark burnished ware at Lerna to the FN, which is what we have also observed in the Kastria Cave (Katsarou and Sampson 1997), *i.e.*, by the end of 5th millennium BC. These comparable pieces allow us to review Phelps's (2004, 112–113) older criterion of surface modification as a way of distinguishing between the LN and FN styles. With regard to the 'burnished v. coarse surface' as supposedly marking a chronological divide, my approach here is rather to consider such ceramic features as part of a fluid and living world of material transformations to long-held legacies, and not to make judgements based on some preconceived evolutionary model, involving the rise and fall of styles.

Possible painted fragments (Figure 5.10)

All the evidence for this category comes from the interior surfaces of vases. A black slipped band is visible on the inner side of the dark red bowl 275. A doubtful red zigzag occurs on the grey interior of bowl fragment 133.

Table 5.9. Number of slipped and worn-away interior surfaces per general group (for 142 fragments with preserved evidence out of the total of 306)

	<i>Slipped (exterior plain)</i>	<i>Slipped (exterior slipped)</i>	<i>Worn away</i>
Plain monochromes	28	9	8
Plain coarse basins	2	–	–
Polished monochromes	2	49	1
Banded jars	10	6	4
Grey/black burnished monochromes	1	22	–
Total	43	86	13

Finally there is a wide black slipped band on the interior of coarse deep and vertical jar 236. Most possibly they are due either to some random localised concentration of the slip or an experimental attempt at decoration by the potter.

Life empowered in a context of death

From the evidence of Ossuary I, the cave of Alepotrypa had been long known and already visited for almost two millennia before the FN community began to bury their dead in the ample niche located halfway into the dark interior. Presumably they would not have been visiting the cave for the first time, and actually would have had their own personal memories about the place. Alepotrypa had surely been part of the local narrative of their parents and predecessors, maybe figuring in the community's mythology from long past.

The funerary event that occurred in Ossuary II was intended as a large-scale performance from the beginning: one seemingly determined to involve time and location far beyond the temporal and physical boundaries of the actual location in the cave. The community had first collected the bones of numerous individuals, with emphasis on their skulls, from the location(s) of their original place of decay. Such bones and skulls would have been moved to the Ossuary in a defleshed condition, as is shown by the evidence of the disarticulated mandibles (Papathanasiou 2001, 33). A timespan of at least 3–5 years after inhumation is probably implied (Triantafyllou 2008, 146). Any assessment as to whether the dead of Ossuary II were first buried or not must rest upon their high quality of preservation as opposed to most of the other bone remains known here: they feature no traces of the sort of weathering attributable to the surface exposure of the dead, except for a few rodent gnaw marks perhaps indicative of some surface exposure or temporary burial before the bones were transported to the cave (Papathanasiou 2001, 33).

Whether the primary burial occurred inside the cave or outside is a pressing question. The presence of any pottery fragments from earlier periods with the reburied

material of Ossuary II would be a strong argument that their original resting-place had been somewhere inside the cave, on the supposition that any removal of earth from any locus in the cave might bring with it some earlier pottery together with the bones (it being further argued that most of the cave had been occupied in prior periods). This line of reasoning indeed could account for the two likely EN ceramic fragments (73, 258) that have been detected within Ossuary II, even though the chances may seem remote.

The secondary re-deposition of the human remains was not, however, occasioned by some random act of upheaval, but was carefully implemented according to a series of practices demanding the expenditure of some effort. To be exact, it seems that the visible surface of the existing fill here was first suitably rearranged by spreading a layer of stones mixed with pottery fragments, although it is possible that these two components were laid one on top of the other. It was on top of this artificial layer that the relics of the dead were scattered, though a deliberate pattern of sorts is observed with certain concentrations across the area seen in terms of the amount and kind of skeletal parts distributed.

The primary focus of the living community has obviously been on a particular manipulation of the position of the skulls: in particular their placement in an upright position at the centres of circular areas marked out by a stone kerb, or inside fragmented pots. Further effort was expended in the selection and grouping of the post-cranial fragments in the intermediate or remaining spaces, although an accurate picture of this dispersal has not survived. As Papathanasiou notes (2009, 23) 'cranial bones represent at least twice the number of individuals as postcranial bones, thus pointing to selective reburial, where preference was given to the skull'.

No attempt was made to respond to the disarticulation of the lower mandibles from the skulls as a result of natural decay, to keep them with the skull proper. Todaro's (2012) recent assessment of comparable evidence of mandible dislocation in primary burial contexts at Phaistos, Crete, and Tsepi, Marathon, has shown that this action was the first step in a series of rituals even occurring while the dead were still interred, before total disarticulation and selective gathering of the bones had taken place. Talalay (2004), in a synthetic assessment of Neolithic skull treatment in Eastern Mediterranean contexts, has observed that while mandibles are generally removed during skull modification and worship, they may be replaced in plaster.

This event was further complemented by the involvement of fire, as is testified by the evidence of charcoal retained in the pots, and indeed dispersed all throughout the Ossuary. The reference to *dark burnt soil* in the excavation archives may imply some extended burning, but how strong and how much cannot now be verified. Purification or fumigation practices have been suggested as possible reasons for the use of fire in

EBA tombs (Schoep and Tomkins 2016). Whatever the case may have been, any burning there was not strong and devastating enough to cause any real damage, as neither the bones nor the pottery showed any evidence of secondary burning, not even any soot deposition. One may argue that the restricted space of the Ossuary inside the cave would not allow people to light fires here, but as even inner locations in the cave displayed extensive burning events at the same time, it seems that physical limits were not critical.

This unusual mortuary project ended with the decision by the living to fully and safely cover the entire bone assemblage with a very distinct stratum of plain earth, deliberately devoid of any artefactual or human bone content.

Ossuary II of Alepotrypa attests to a surprisingly extensive programme of veneration in the range of decisions and the labour of actions undertaken, as well as being the most demanding seen within its chronological and regional correlates on the Greek mainland. The goal of the arrangement was not so much the funereal inhumation of the bones, but the elaboration of a visible mortuary arrangement to be revered. Barrett (1988) distinguishes between 'ancestor rituals' for the latter, from 'funerary rites' for the former. The ritual display of disarticulated bones has already been associated with the contemporary burial context of Ossuary I at the entrance of the same cave, where a credible instance of a skull on display has been hypothesised. Outside Alepotrypa, the literature on this issue is gradually growing, with a few references to such as a 'shrine platform' (Talalay 2004, 152) or some initial suggestions of the exhibited dead at a post-inhumation stage (Triantafyllou 2008; Todaro 2012). But here it is the substantial communal effort made towards the realisation of mortuary visibility and the sheer size of the context that renders the ritual aspect really remarkable.

Mortuary practices in the Greek Neolithic have so far been discussed from the perspective of funerary rituals, whether primary or secondary, and from the angle of implied eschatology, patterning of social practice, displays of wealth, and inferences on hierarchical relations within the household communities (Fowler 2004; Cavanagh and Mee 1998). While not denying that death had long since brought into being metaphysical ideas in the minds of Neolithic peoples, I would not regard the event staged in Ossuary II as intrinsically religious (in terms of expressing concerns for the afterlife), and I would likewise avoid explanations in terms of aspects such as subsistence and identity. Instead I would regard the ritual aspect of this mortuary act as impressively elaborate and very socially bounded. Therefore I would rather direct my inquiry towards the social arena of the living community, where the dead are manipulated so as to become players in some reconfiguration of social dynamics (Barrett 1988; Chapman 2000; Triantafyllou 2008; Thomas 2000; Hamilakis 1998). The rituals practised in Ossuary II

would, I believe, recall Barrett's (1990) argument that mortuary rites constitute one element of a suite of practices through which communal values are continually brought into being. The vista where skulls were displayed mixed with a sizeable assemblage of other skeletal material constitutes the backdrop against which could be played out a performance negotiating the relationships between the living and the dead. Aspects negotiated would have included authority and affiliation which can be transformed or reaffirmed in the course of the mortuary ritual (Thomas 2000; Chénier 2009; Laneri 2007). It is not actually the precise cultural position of the deceased that was secured during this performance, but the communal and social equivalents of the living finding form through the veneration of the dead. The evidence for ritual staging and worship may actually explain why the secondary treatment of the dead was undertaken, that is, to create a social sphere within the mortuary arena where communal affiliations could be restated.

Contrary to the premise of Metcalf and Huntington (1991, 13, commenting on older literature) that societies who practise secondary burials do not see death as instantaneous or a quickly achieved process, the secondary mortuary event of Ossuary II seems to offer a definite argument for the existence of a period of time (length unknown) being required for such rites of passage and the wanderings of the soul. In this sense I would regard the rhetorical question of Laneri (2007), 'burial or not burial, that is the question', as more appropriate. In fact death and burial constitute closely interdependent social values, as far as, in the post-burial context, death provides an argument for the power of the living. In an antithetical but complementary reading, I would constrain the actual aspect of dealing with death to the primary burial sphere, and remove any reference to it from the secondary mortuary procedures seen in the Ossuary II. Instead I prefer to place this secondary stage within a living tableau, a playing out of the immediate concerns of the existing community.

Given the social significance of the context, it is important to review its sequence of events to find out if there are hints of separate deposition phases within it, or whether it was a single episode of deposition, performance and closure. The excavation reports do not record nuanced details of stratigraphy. The layering of the stone substratum and the bone fill seem to be of a piece, but it could yet be that the latter was not a single act, but was composed of micro-histories of additional or separate depositions, occasions when people would bring in the relics of their dead and arrange or re-arrange skulls and bones for veneration and display. It would thus be possible that the rituals involving the skulls and bones were re-enacted; by this recurrent ceremonial observance, a contextualised set of memories set within ritual practice would have been created (Kuijt 2008). In a Near Eastern context, Talalay (2004, 155) also poses a relevant and

stimulating question on how passive or active a role the skull played in the performed ritual. The repetition of these smaller episodes would not have undermined the fact that the event was of short and concentrated duration, and thus a socially coherent occasion.

The social perspectives emerging from the array of visible mortuary practices in Ossuary II imply the existence of an underlying communal composite by which the collective spirit of the group is reinforced. I wish to develop this thought on two fronts.

In the first place, the impressive nature of Ossuary II argues for the existence of a centralised social arena, where discussions, mutual agreements and inter-individual dynamics between the people of the community are played out. Kuijt (2008, 175) regards secondary mortuary rituals as high-profile public ceremonies with social and political overtones, involving different households and requiring extraordinary community involvement. Timing is vital: one of a long list of practical requirements to be resolved upon on a communal basis would have been to work out the time needed for the necessary decay and then to plan ahead for the exhumation so as to align or at least not conflict with other tasks of the community, such as a season of festivities. Talalay (2004, 153) points out that 'individuals or collectives would have been required to oversee the arrangements for initial burial or excarnation, the subsequent retrieval of dismembered elements, and the final installation of skulls or post-cranial remains', not forgetting the conspicuous food consumption that may have accompanied these acts.

We may be able to infer that communal agreements would require some degree of hierarchical order within the community of Alepotrypa, but not in the sense of there having been a true elite in place. I would rather not view the rituals as markers of inequality and differentiation of social status, as has usually been argued, on the basis of mortuary practices and cross-cultural ethnography (e.g., Carr 1995; Tainter 1978). Nor do I intend to interpret the energy expenditure observed as a manifestation of some high social position of the deceased (Fowler 2004) or draw conclusions about the chances of high rank for the social group who took the responsibility for them. Mortuary practices were not the visible concretion or reification of social structure; I do not consider here the mortuary rituals as a systemic entity where all parts are determined by processual change (Shanks and Tilley 1982).

My understanding of their social construct is one where the basis of the community ideology is an overarching 'political plan' shared by the group and supported by mutual dialogue to put it into action. It is because of the need to promote mutual relations and values that this effort has to be undertaken. We may not, however, be able to further define and describe the criteria generating this plausible social condition, be it gender, age or kinship. Papathanassopoulos (2011) would welcome the idea for Alepotrypa as a site of 'ritual pilgrimage' for people

originating beyond the area, which is a scenario that new data may even support. The idea that Alepotrypa may have been a centre for rituals with people beyond the community also being involved was suggested by Cavanagh and Mee (1998). Whilst this may indeed be true, it yet should be explored against an overview of the cave's burial locations. However, according to the biometric analysis on the demographic group of Ossuary II in particular, carried out by Papathanasiou (2009, 25), the dead in that location show a high prevalence of hereditary features (specifically metopism) indicating their genetic affinity. The kin lineage thus implied may have been of high social importance for the related members of this particular group and their concentration in this particular locale: it would thus be regarded as a very critical substance ensuring social coherence for determining crucial decisions for their ancestors and themselves.

To date, a communal structure in Neolithic mortuary behaviour is vaguely assumed from the formal cemetery of Kephala, Keos (Coleman 1977), the only burial site with a large number of graves. At Kephala the separation or clustering of the graves and some structures built between them challenges the speculation that the individual status of the dead is associated with group origin, but, perhaps indicates some social group structure that would regulate burial land management, rights and holdings. Secondary burials, commonly practised in the Greek and European Neolithic (Fowler 2010; Cavanagh and Mee 1998), may however be more eloquent manifestations of this collective spirit. One such secondary episode involved the deposition of 11 skulls under an EN house floor in Prodromos, Thessaly (Hourmouziadis 1971, 167): this event may be in fact more closely parallel to Ossuary II because of the number of the dead involved and the labour and planning invested by the living to carry it out within a house-unit. In Neolithic settlements it is the household that is the focus of social behaviour, hosting the infra-communal politics and managing the ties between the families or other groups (Halstead 1999; 2011). Most arguments draw evidence about large- and small-scale feasting events on an intra-household scale (Pappa *et al.* 2004; Tzevelekidi 2012), which would necessitate a shared public interest and action to become possible. Mortuary rituals of the extent seen in Ossuary II definitely demand that such interconnections be in place among the community in order to settle on, organise, direct and effectuate the project.

In terms of the bigger picture, however, our knowledge of the collective rituals of Neolithic communities is but fractured; a more complete picture remains elusive. With a fresh understanding of the present ritual evidence at Alepotrypa, we may now revisit the older records from other cave sites to get an update. The secondary manipulation of individual skulls, usually placed inside wall niches, as with the young child's skull at the Skoteini Cave, Euboea (Sampson 1993, 266–267), or as with

more skulls from the Kalythies Cave, Rhodes (Halstead and Jones 1987, 164), and the Hagios Nikolaos Cave at Astakos, Aitolioakarnania (Benton 1947, 156–158), is hardly evidence of large communal projects, though they may reflect small-scale practices of veneration and social history. A reconsideration of these cases in addition to our knowledge from the intramural ossuary at Prodromos (Hourmouziadis 1971), the ossuary-grave at the cemetery of Tharrounia (Sampson 1993), alongside newly observed treatment of the skulls at the open site of Paliambela (Triantafyllou 2008) and Phaistos, Crete (Todaro 2012), all will bring new weight to bear on the argument for the ritual significance of the human skull and its social connotation for the Neolithic communities of the Greek mainland. The occasional retrieval of decapitated figurines (Talalay 2004, 149–151) strengthens this impression. Taking a wider look at this 'heady business' (Talalay 2004) from the Near Eastern/Anatolian (but also northern and central European) Neolithic perspective may prove stimulating for investigating the challenging issues of remembrance, ancestral ties and kin-owned territory in the Greek context, despite its striking difference from the eastern patterns in terms of the lesser extent in Greece of both the practice within the households and the elaborate modelling of the skulls (Kuijt 2008; Özdoğan 1999; Saville 1990; Borić 2014).

Taking up a point from the large picture, I return to Ossuary II of Alepotrypa to explore more specifically debated social issues concerning the basic communality that are implied by this funerary program. The specific range of the negotiable values itself deserves further notice. What comprises the particular ideological and ethical position within which this laborious effort had to be undertaken? Why do mutual approval and convergence have to be exercised? What motivations sustain the physical, social, and ritual concerns driving the practices? Is there a place for sorrow and bereavement, for sadness at the loss of companions?

My response to this array of issues would be along the lines of a negotiation of social priorities for the present and future of the living community in the context of kinship, whose existence is implied by the anthropological study; in other words I would see here an immediate claim to the land.

Though my opinion is certainly speculative, I would challenge the viewpoint that extensive and collective funerary action seen in Ossuary II was aimed at strengthening the prospects of the living community, to preserve communal memory and tradition, and employ ancestry as a tool of power for negotiation of their future. Knowing the lineage of the group is of utmost importance here in assessing the theoretical argument apropos the multiple perceptions of the dead by the living – as commemorated persons, ancestors or kin. Whoever arranged Ossuary II was concerned for the position of the community as a whole, not for the parents or the

grandparents as commemorated persons. To look at the issue from the evidence from the open-sites, boundaries for single Neolithic burials by piling up heaps of stones or constructing low mounds (Georgiadis 2009) is a known way of marking the burial ground with a material statement signifying the ancestors and ancestral land.

The claim obviously does not arise from the feelings created at a personal level for the loss of an intimate, a person within a family or a group of friends. Displaying parts of more than 14 individuals, removed from their primary entombment, in this particular chamber in Alepotrypa was not done to cure somebody's sorrow for their dead parents. Personal loss may indeed have been part of the significances of the deceased of Ossuary II, but only as a circumstantial and temporal matter that did not power the vigour of the entire mortuary performance. If issues of individualism and personalisation arise within the social arena of the mortuary context in Ossuary II, it may be in favour of the *collective* ancestry. Personal worship and particular life histories, although they may exist as part of a very intimate perspective (Robb 2007), may also work towards establishing a communality of 'fathers' for as long as certain individuals or any social personae (Talalay 2004) from the living community associate themselves with the displayed skulls.

The skull and the other remains of the bodies transformed here into the 'ancestors' can be socially manipulated as mnemonic devices by which those who bury the dead address (kin) territorial claims. It may be of some importance to notice that children are also represented in this mortuary record, from the age of 5 upwards, which may indicate the possibility that children were influential agents in the power dynamics played in the community (Triantafyllou 2008). They were endowed with the attribute of ancestorhood, even though they had departed before generating any natural successors. Ossuary II also testifies to the deliberateness of the recurrent and forceful disarticulation and de-individualisation of the deceased through the dispersal of their skeletons. On this point I think it is important to take into account the recent remark by Todaro (2012), namely that mandible dislocation practices were deliberately pursued to produce the de-individualisation of the deceased by the destruction of the physical integrity of the corpse, as part of a long process that would eventually assign to the dead individual the depersonalised status of an ancestor.

Thus I see here the employment of the politics of death, undertaken by the community at large and in a forceful manner that carries with it the claim of territorial ownership to the cave or part of it. Viewing Alepotrypa as a place of death, because of its awe-inspiring underworld setting, is however to ignore the fact that the place had been an active domestic arena, hosting household practices, at the same time. Bearing in mind that the large space of Chamber B and the North Sector, immediately preceding Ossuary II, hosted an enormous

domestic establishment for food storage and processing, the veneration of the dead in the next 'room' was but an integral part of the setting for the living who would be always around. That the overlap of the domains of the living and the dead is actually an essential and intrinsic element of the Neolithic story, is attested by the record of traces of the human dead within domestic fills in house structures. This is now strengthened with more evidence of domestic and funerary material overlapping in caves. Caves are anyway shelters, like the home, and can provide protection for the security of the ossuary from the dangers of weather, as well as from human menace.

This co-occurrence must have ensured an 'engagement' with the dead to a considerable degree. Death itself, decomposition, and decapitation would have been familiar and anticipated components within the Neolithic domestic realm (Kuijt 2008). Our Western divide from death, and its expulsion from the physical and metaphysical realms as alien and fearful, is poles apart from the attitudes of the Neolithic communities, whose relationship with the dead acts as a catalyst in the workings of their social institutions. Thus, Ossuary II, in attesting to a long process of exhuming, collecting, and possibly cleaning the skulls and the bones of flesh, would indicate that touching the dead (Hamilakis 1998) was a familiar experience. In the mortuary ritual the physical engagement of the living with the dead would involve the transportation of the bones in containers, cloths or baskets, although the extent of any actual handling of the displayed relics is unclear. The placing of a skull inside a pot may also imply a similar movement of the dead (Kuijt 2008), as well as offering an occasion for display. The adjoining domestic establishment inside the cave, discussed below, is part of the living-with-the-dead experience.

To discover who established Ossuary II, whether from the same or a different community, would necessitate further speculation, analysis and comparative research within the cave's material records. Would nearby residents bring their dead here to keep them within their territory? Would a competing community bring their dead here to claim shared ownership of the land? Renegotiating upcoming or long-lasting tensions or affiliations may lie behind a mortuary practice (Chénier 2009), such as denoting publicly a declaration of land rights inside the cave. As any earlier deposits were not sought under the mortuary context of Ossuary II, any trans-generational background to this claim cannot be established.

Given the marked clustering of genetic affinity traits detected in the population of Ossuary II in comparison with their low or non-existent presence in the populations from other locations of Alepotrypa, we may actually be able to infer a low degree of intermixing with other groups. Pronounced biological links may account for social trajectories taking precedence over those of kinship, culminating in violent kin-nuanced competition over physical territories (Cullen 1995; Papathanasiou 2009) –

be these important either as functional households and subsistence resources, or as historical and ideological symbols of the group. Therefore Ossuary II may express such a statement for ownership of space, empowering claims to territorial domination between competitive groups of different or disassociated kinship. Therefore I would regard the construction of Ossuary II as a resonant act in the public arena in support of kin and land-history ties, in order to assert present claims and establish future prospects.

Mortuary in a fragmented home

But what material tools are implemented to serve the mortuary project here? What artefacts act alongside the human relics to homogenise the social landscape? Having described the stratigraphical manipulation in terms of the arrangement of the skulls and the dispersed skeletal and other matter, I now consider the equipment that accompanies this arrangement and the ways in which it is implemented.

The artefactual context of the disarticulated bodies was composed of fragmented pottery vessels, alongside a few complete stone tools and a mass of animal bones whose study is in progress. Indeed ‘fragmented’ is the operative word for material found in Ossuary II, yet another example of the widespread practice in the Neolithic contexts. I will not expand upon the immense variety of domestic or ritual fragmentation which is widespread in house and cave contexts of the Greek Neolithic, as well as even in inner non-funerary locales of Alepotrypa Cave itself (Psimogiannou, this volume). I will rather limit my discussion to the significance of this fragmentation practised with regards to the specific context of staged mortuary in Ossuary II. What sort of fragments make up this material, and what sorts of wholes would they have come from?

In their shapes the containers from Ossuary II fit perfectly into the range of domestic pots attested in the FN contexts at the neighbouring Chamber B/North Section households. Similarly there is an extensive overlap with shapes found in the area outside of the cave. Summarising the discussion above, the fragments in Ossuary II originate from a wide range of vessel shapes, mainly featuring plain wares with red coloured surfaces and rough manufacturing attributes. Prevailing shapes include deep, convex and spherical rimmed bowls and very wide and oval basins with flat bases, roughly fabricated and bearing perforated rim-sides and decorative impressions on the rim-top. An impressive scoop-hybrid is also attested. The mortuary context also contains a considerable collection of medium-sized, deep and vertical or wide-mouthed and inverted jars with varying banded decoration, although their size is not comparable to the very large storage jars found in the nearby domestic deposits. A small quantity of fine tableware also exists, including shallow bowls and a

few deeper and lustrous thin-walled vessels: these differ from the prevailing mass of rough containers in terms of elaborate modification. Comparing Ossuary II with the domestic assemblages of Chamber B/North Sector, the main differences of consequence between them would seem to be in the quantitative prevalence of small- and medium-sized, open and broad containers in the latter area, and the lack of oversized storage jars in Ossuary II.

A very challenging aspect of the containers unearthed from Ossuary II is the considerable level of use wear that can be observed in their interior surfaces. Many poorly preserved interior surfaces may owe their condition to intense use, as a comparison of the damage with known use-wear patterns vouchsafes, but there are several vessels, mainly among the deep and wider sizes, where overuse has rendered them quite worthless. Their inner sides have become excessively eroded, right down to the core, and are rough in texture, most probably from continuous exposure to acid foodstuffs. The decent state of preservation of the slipped and plain surfaces on the exterior of the same pots, even in places within the same vase interior, well substantiate the fact that the roughness and erosion originated from Neolithic activity and are not the result of post-depositional conditions. They could not have become so deeply damaged after being used once or a few times on that spot; a longer repetitive use outside the present context more plausibly accounts for their total worthlessness. Other vessels attest to burning traces and soot deposition from a cooking fire; the build-up of soot is indicative of repeated contact of the vessel with fire, rather than the result of one cooking event.

Many of the ceramic vessels from Ossuary II, in particular the bowls and basins, are so carelessly manufactured from the outset that they seem in a quite dreadful state to our eyes. Whoever scraped the outside wall of a perforated basin with a hard brush did not seek to improve its condition later, but left a very obvious and uneven exterior surface gouged by pulled-out stone inclusions. This contrasts highly with the close attention and elaboration that the potter would show for decorating the rim and in the banding of the same basins. One even begins to wonder if the emphatic roughness was deliberate. This carelessness also contrasts with the remarkable elaboration of most of the banded jars, bearing slip and polish and usually being also finely modified on the interior.

Indeed, if there were no bones present in Ossuary II, the place would be easily assigned a domestic profile. Perhaps it should be? Perhaps, instead of looking for a divide between the domestic and the funerary, we should rather accept that the two overlap? I have commented above on the issue of ‘living with the dead’ (Triantafyllou 2008), but want to expand the discussion here from the pottery side of things.

A rapid overview of the Greek Neolithic funerary record would easily bear out the intrinsically domestic

character of the ceramics employed in the burial practices and the presence of ceramic equipment typical of the household, although with multiple local ways of handling their deposition. In the major FN burial site of Kephala, on Keos, it is plain cooking, serving and storage household vessels that were gifted to the dead (Coleman 1977). Kephala, still in use at the FN/EBA transition, actually provides an eloquent example of this death-at-home Neolithic context if looked at from the EBA side: then elaborate fruitstands, marble figurines and marble containers emphasise the evolving social changes, moving towards status distinction (Coleman 1977, 51). Because of this move in the EBA towards an expression of elitism through burial goods, the occurrence of the unusual scoop vessel in the FN context of Kephala has been debated: were such scoops placed in tombs because they were particular artefacts, or were they, like any other plain household pot, seen as a potential burial offering? This same question can be asked of the very particular rim-perforated scoop-hybrid from Ossuary II.

More data from Kouveleiki A, Geraki (Koumouzelis 1989, fig. 18), shows that the FN inhumation was put inside a common coarse, biconical storage jar and covered with a deep monochrome bowl. Domestic jars, basins and pans accompany Burial IV at Proskynas, Phthiotis (Psimogiannou 2008, 99–102). A more elaborate situation involving offerings such as painted ceramic vessels together with figurines has been revealed inside an ossuary at the same site (Psimogiannou 2008, 36–41 and 99–102). Plain shapes are attested at the EN ossuary of Prodromos (Hourmouziadis 1971, 165). It is only in the context of cremations in MN Soufli Magoula (Gallis 1982) that a repeated choice is made for a certain skyphos to contain the human remains. Even so fragments of plain monochrome vessels, some only polished, are still being offered to the dead. Indeed one bowl has perforations along the rim (Gallis 1982, pl. 17b), a distant but tempting morphological link with the perforated basins from Ossuary II. On the other hand the LN cremation cups from Tsangli, Platia Magoula and Dimini (Gallis 1982, 97; Papathanassopoulos 1996, 343, no. 311) are common domestic and elaborate tableware introduced into a funerary context.

But most eloquent of all is the fact that the neighbouring storage and dwelling context at the North Sector contains equally rough and deformed basins of a similar shape as are attested in Ossuary II, and an equal quality, though not quantity, of banded jars and cooking- and tablewares.

The coarse vessels may indeed seem unattractive and useless, but they should not be judged by our standards. To repeat, any automatic assumption on our part that coarse pottery is of a low value and of an everyday domestic function, somehow in conflict with the expectations of what was appropriate in funerary situations, is poor and biased thinking. The correct disciplinary approach demands that Ossuary II be assessed on its own particular merits and as a result of active negotiations of ideologies.

More than being directed automatically by some kind of generic cultural structure, the personal and situational readings of this culture may have configured new versions to be established or rejected, *e.g.*, the mottling skill may have emerged from the firing mistakes, or the banded decorative pluralism may have been a recasting of original random, occasional and inaccurate finger impressions. The approach that contextual significances would operate according to contextual rules rather than transcultural norms is a fair assessment, doing justice to the vast amount of humble and indistinctive expressions that have been decided, signified and wanted as such by prehistoric individuals.

Is the fragmentation seen here therefore possibly the societal manifestation that would make this ‘domestic’ context of Ossuary II securely seen by those responsible for its creation as mortuary?

The ceramic pieces recovered from Ossuary II do not comprise complete pots, although most pieces preserve substantial parts of the original vessels. Their purpose was perhaps to carry foodstuffs, and probably to convey the human bones and skulls. The absence of joining pieces within the deposit may find an explanation in the fact that they had not existed as whole pots at the time the Ossuary was established, but rather had been fragmented earlier and were carried here in an already broken condition. Or, it may alternatively be that they had been broken at the Ossuary, and some parts were buried and others removed. The preservation of most potsherds in large pieces and with fresh rather than eroded edges to the sherds implies that they had been broken only for a short while before deposition. Even if that breakage took place before the rituals, the Ossuary II fragments were not collected from earlier occupation rubbish.

Breakage was and is an integral mortuary rite across time and world cultures (Grinsell 1961), and seemingly an essential constituent of Greek Neolithic mortuary behaviour (Fowler 2004). A brief overview of the pottery accompanying Greek Neolithic burial assemblages of all sorts does confirm that pots offered are present, and intentionally so, in parts: perhaps they were ‘killed’, but partially deposited or, most often, constituted a random dump of ceramic ‘orphans’. Kephala cemetery attests to an overlap of all these categories, though most burial contexts yield only a scatter of non-joining ceramic sherds. Deliberate breakage has been extensively validated in the Bronze Age and by ethnographic evidence, but is also widely attested in non-funerary contexts (Chapman 2000). This very question has been asked of the material in Chamber Z of Alepotrypa Cave, with its huge assemblage of ceremonial destruction and dispersion, generation after generation through the millennia (Papathanassopoulos 2011; Psimogiannou, this volume). Assessing the overall picture, it seems that Ossuary II was from the start supplied with only parts of pots. The mortuary enactments seem to have experienced the breaking in situ of new,

perhaps deliberately fabricated vases, as well as of old containers that were used for the event one last time, and the odd domestic piece.

Against what definitions and purposes of completeness should we thus consider this context of fragmentation? Revisiting the contemporary mortuary practices of Ossuary I, the complete and the fragmented may actually meet on that fluid platform where concepts of life and death merge, and values are intertwining, not opposing nor overlapping on separate levels of importance. And the apparently useless and worthless fragments should not be judged as being less meaningful and important, just as with these fragments in Ossuary II. Brittain and Harris (2010) have even posed the following question: why is it safe to assume that the objects we encounter in prehistory were ever designed to be whole? Bailey (2007) would even argue that in some cases an object may have been calculatedly produced in an (and perhaps abstractly) incomplete state, with the focus of attention on the absent part being the intent. Last (2006) would argue for the possible significance in and by itself of a single potsherd.

The Ossuary II pottery probably achieved its state of incompleteness by actions carried out after manufacture and use. Together with the ceramics, a mass of faunal material, a few samples of used chipped and ground stone and a rich fill from combusted organic matter make up the whole contextual picture. Moving beyond functional explanations for the occurrence of tools in the burial context of Alepotrypa, I would point to recent arguments supporting the symbolic significance of the chipped stone in Neolithic and EBA tombs (Carter 1994; 2007), and also extend this reading to the few pieces of polished stone tools from Nea Nikomedeia (Rodden 1962). The presence of the ax under skull 11 inside the flat jar base should recall an observation by Talalay (2004, 149–150) on the possible metaphorical association of the FN cutting tools with the human skull, on the basis of a comparable morphology between tools and acrolithic figurines. The presence of pebbles in the context of Ossuary II may be equally intended to represent the domestic aspect of a house floor. The placement of skulls on a specially prepared base and the manipulation of a floor may elevate the burial and household levels into one integrative whole. The clay red ochre floor laid to receive the Phaistos skull (Todaro 2012) is the best comparison to the situation in Ossuary II. There is no need to repeat here the many cases where funerary and domestic floors overlap (*cf.* Prodrornos and Kephala, again).

Scattered within the bone mound, the huge ceramic basin with its many joining fragments is a potential key artefact. The container's over 30 surviving fragments, however, only make up about half the vessel, to a width of 40 cm and an equally preserved height. The equivalent basin from Ossuary I, comparable in size, profile and modification, also survives in multiple pieces, though not joining, and makes up less than half of the entire pot. The

repeated mortuary occurrence of this basin-type in the cave is worth noticing and considering here. The container could carry many portions of food to be shared by a considerable number of fellow diners. More pots would serve for the individual preparation and consumption of food. At the event's end everyone renders the pot in their hand functionally worthless.

A true functional non-existence is later transcended when the broken lower body of a jar is used to hold burnt ashes along with a whole skull and an offered stone axe. It was not their completeness that had made these pots meaningful in this context. It was rather their broken state: whether it had already occurred in a household context by accident or whether it was deliberately done on top of the burial ground of Ossuary II. In either case the ceramic fragment was deliberately sought and chosen from its broken ceramic associates. The context is 'eaten up'. So speaking, Ossuary II is a forcefully devastated context: a dead household that has been 'consumed' to stay alive. The living would seek through the dismembered human and material bodies to create the essentials of a household to so extend their existence, positing claims of ownership, ancestry and history. In this mortuary house the domestic matters and equipment of daily life are revisited, from ceramic vessels and tools, perhaps through foodstuffs and cooked meals, even to the very floors underfoot, alongside the nurturing and warming fire. All are animated existential claims on life, nullified and devoured by death.

Conclusion

The funerary event performed in Alepotrypa Cave was intended to transcend the limits of both an individual life and personal traumatic and emotional loss, to take on a multi-personal presence. The potent actions of the living are above all an exercise in necropolitics and necrorituals conducted at the very place of rest, to establish claims of life for the present and the future and to be carried out at some critical juncture in their social history and as the reaffirmation of community membership. Ossuaries I and II seem to have been created not as true cemetery areas, but as monuments, aids to memory and areas for veneration, a challenge to constant social reconstitution, renegotiation and homogenisation. They are not directly comparable in terms of scale, but may argue for some repetitiveness of ritual across the community, and thus to the existence of some formalised and conventionalised messages that would be publicly understandable. To bring the dead 'home' was probably aimed at promoting claims and encouraging the revisiting of the places where they were visible in order to remember. Although the dead are no longer present, they do not belong in the past (Kuijt 2008). It is remarkable to consider that it was through the dismemberment of dead bodies that the social order in this small Neolithic community of Alepotrypa was kept together.

We do not know what social priorities and transformations drew the community of Ossuary II to organise the staging of the mortuary. Was it an enduring part of the communal politics from the beginning? Does it imply some mobility of the group? Did it result from some break in social continuity and cohesion or from some mutual agreement and consent? It may seem as if the spread of the final fill marked some conclusion to the multi-bodied osteobiography of this community (Robb 2002). This site then becomes a true burial locale, where the dead cease to be seen as social bodies. But it leaves a question behind: for whom was this meant to happen? For those staying or those leaving?

Maybe this is the time when the Dead become finally dead.

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Bibliography

- Bailey, D. W. (2007) The anti-rhetorical power of representational absence: faceless figurines from the Balkan Neolithic. In I. Morley and C. Renfrew (eds) *Image and Imagination: A Global Prehistory of Figurative Representation*, 117–126. Cambridge.
- Barrett, J. C. (1988) The living, the dead, and the ancestors: Neolithic and Early Bronze Age mortuary practices. In J. C. Barrett and I. A. Kinnes (eds) *The Archaeology of Context in the Neolithic and Bronze Age*, 30–42. Sheffield.
- Barrett, J. C. (1990) The monumentality of death: the character of Early Bronze Age mortuary mounds in southern Britain. *World Archaeology* 22, 179–189.
- Benton, S. (1947) Hagios Nikolaos near Astakos in Akarnania. *Annual of the British School at Athens* 42, 156–813.
- Borić, D. (2014) Mortuary practices, bodies and persons in the Neolithic and Early–Middle Copper Age of Southeast Europe. In C. Fowler, J. Harding and D. Hofmann (eds) *The Oxford Handbook of Neolithic Europe*, 1–23. Oxford.
- Brittain, M. and Harris, O. J. T. (2010) Enchaining arguments and fragmenting assumptions: reconsidering the fragmentation debate in archaeology. *World Archaeology* 42, 581–594.
- Brück, J. (2006a) Fragmentation, personhood and the social construction of technology in Middle and Late Bronze Age Britain. *Cambridge Archaeological Journal* 16, 297–315.

- Brück, J. (2006b) Death, exchange and reproduction in the British Bronze Age. *Journal of European Archaeology* 9, 73–101.
- Carr, C. (1995) Mortuary practices: their social, philosophical-religious, circumstantial, and physical determinants. *Journal of Archaeological Method and Theory* 2, 105–200.
- Carter, T. (1994) Southern Aegean fashion victims: an overlooked aspect of Early Bronze Age burial practices. In N. Ashton and A. David (eds) *Stories in Stone*. (Lithics Society Occasional Paper 4), 127–144. London.
- Carter, T. (2007) The theatrics of technology: consuming obsidian in the Early Cycladic burial arena. In R. Flad and Z. Hruby (eds) *Rethinking Craft Specialization in Complex Societies: Analyses of the Social Meaning of Production*. (Archaeological Papers of the American Anthropological Association 17), 88–107. Arlington.
- Cavanagh, W. and Mee, C. (1998) *A Private Place: Death in Prehistoric Greece*. (Studies in Mediterranean Archaeology 125). Jonsered.
- Cavanagh, W., Mee, C. and Renard, J. (2002) Kouphovouno (Laconie). *Bulletin de correspondance hellénique* 126, 583–589.
- Cavanagh, W., Mee, C. and Renard, J. (2004) Sparta before Sparta: Kouphovouno 1999–2000. Report on the intensive survey at Kouphovouno. *Annual of the British School at Athens* 99, 49–128.
- Chapman, J. (2000) *Fragmentation in Archaeology: People, Places and Broken Objects in the Prehistory of South-Eastern Europe*. London.
- Chapman, J. and Gaydarska, B. (2007) *Parts and Wholes: Fragmentation in Prehistoric Context*. Oxford.
- Chénier, A. (2009) Bones, people and communities. Tensions between individual and corporate identities in secondary burial ritual. *Nexus: Canadian Student Journal of Anthropology* 21, 27–40.
- Coleman, J. E. (1977) *Keos I. Kephala: A Late Neolithic Settlement and Cemetery*. Princeton.
- Crouwel, J. (2009) Prehistoric Geraki: Work in progress. In W. G. Cavanagh, C. Gallou and M. Georgiadis (eds) *Sparta in Laconia. From Prehistory to PreModern. Proceedings of the Conference Held in Sparta, Organised by the British School at Athens, the University of Nottingham, the 5th Ephoreia of Prehistoric and Classical Antiquities and the 5th Ephoreia of Byzantine Antiquities, 17–20 March 2005*, 67–76. (British School at Athens Studies 16). London.
- Cullen, T. (1995) Mesolithic mortuary ritual at Franchthi Cave, Greece. *Antiquity* 69, 270–289.
- Cullen, T. (1999) Scattered human bones at Franchthi Cave: remnants of ritual or refuse? In P. P. Betancourt, V. Karageorghis, R. Laffineur and W.-D. Niemeier (eds) *MELETEMATA. Studies in Aegean Archaeology presented to Malcolm Wiener as he enters his 65th year* 165–171. (Aegaeum 20). Liège.
- Cullen, T., Talalay, L. E., Keller, D. R., Karimali, L. and Farrand, W. R. (2013) *The Prehistory of the Paximadi Peninsula, Euboea*. (Prehistory Monographs 40). Philadelphia.
- De Marais, E. and Robb, J. (2013) Art makes society: an introductory visual essay. *World Art* 3, 3–22.
- Doukaki, A. E. (2009) *Τα ανοιχτά αγγεία με σπές στο χεῖλος από το νεολιθικό οικισμό της Φτελιάς Μυκόνου*. Unpublished PhD thesis, Aristotle University of Thessalonike.
- Efstathiou-Manolakou, I. (2009) Archaeological investigations in the caves of Laconia. In W. G. Cavanagh, C. Gallou and M. Georgiadis (eds) *Sparta in Laconia. From Prehistory to PreModern. Proceedings of the Conference Held in Sparta, Organised by the British School at Athens, the University of Nottingham, the 5th Ephoreia of Prehistoric and Classical Antiquities and the 5th Ephoreia of Byzantine Antiquities, 17–20 March 2005*, 5–20. (British School at Athens Studies 16). London.
- Fowler, C. (2010) Pattern and diversity in the Early Neolithic mortuary practices of Britain and Ireland: contextualising the treatment of the dead. *Documenta Praehistorica* 37, 1–22.
- Fowler, K. D. (2004) *Neolithic Mortuary Practices in Greece*. (British Archaeological Report S1314). Oxford.
- Gallis, K. (1982) *Καύσεις νεκρών από τη Νεολιθική εποχή στη Θεσσαλία*. Athens.
- Gamble, C. (2007) *Origins and Revolutions. Human Identity in Earliest Prehistory*. Cambridge.
- Georgiadis, M. (2009) Honouring the dead in Mesolithic and Neolithic Peloponnese: a few general observations. In H. Cavanagh, W. Cavanagh and J. Roy (eds) *Honouring the Dead in the Peloponnese. Proceedings of the Conference held in Sparta 23–35 April 2009*. (Centre for Spartan and Peloponnesian Studies Online Publication 2), 163–181.
- Goring-Morris, A. N., and Birkenfeld M. (2008) Kfar HaHoresh: a cult and mortuary site. *Past Horizons* 5, 20–25.
- Grinsell, L. V. (1961) The breaking of objects as funerary rite. *Folklore* 72, 475–491.
- Halstead, P. (1999) Neighbours from hell? The household in Neolithic Greece. In P. Halstead (ed.) *Neolithic Society in Greece*, 77–95. (Sheffield Studies in Aegean Archaeology 2). Sheffield.
- Halstead, P. (2011) Farming, material culture and ideology: repackaging the Neolithic of Greece (and Europe). In A. Hadjikoumis, E. N. Robinson and S. Viner (eds) *The Dynamics of Neolithisation in Europe: Studies in Honour of Andrew Sherratt*, 131–151. Oxford.
- Halstead, P. and Jones, G. (1987) Bioarchaeological remains from Kalythies cave, Rhodes. In A. Sampson (ed.) *Η Νεολιθική περίοδος στα Δωδεκάνησα*, 135–52. Athens.
- Hamilakis, Y. (1998). Eating the dead: mortuary feasting and the politics of memory in the Aegean Bronze Age societies. In K. Branigan (ed.) *Cemetery and Society in the Aegean Bronze Age*, 115–132. (Sheffield Studies in Aegean Archaeology 1). Sheffield.
- Holmberg, E. J. (1944) *The Swedish Excavations at Asea in Arcadia*. Lund.
- Hondrogianni-Metoki, A. (2009) Μη οικιστικές χρήσεις χώρου στους νεολιθικούς οικισμούς. Το παράδειγμα της Τούμπας Κρεμαστής Κοιλάδας. Unpublished Ph.D thesis, Aristotle University of Thessaloniki, 63–155.
- Hourmouziadis, G. H. (1971) Δύο νέαι εγκαταστάσεις της Αρχαιοτέρης Νεολιθικής εις την Δυτικήν Θεσσαλίαν. *Athens Annals of Archaeology* 4, 164–175.
- Howell, R. (1970) A survey of Eastern Arcadia in prehistory. *The Annual of the British School at Athens* 65, 79–127.
- Immerwahr, S. A. (1971) *The Athenian Agora XIII. The Neolithic and Bronze Ages*. Princeton.
- Jacobsen, T. W. and Cullen, T. (1981) A consideration of mortuary practices in Neolithic Greece: burials from Franchthi Cave. In S. C. Humphreys and H. King (eds) *Mortality and Immortality. The Anthropology and Archaeology of Death*, 79–101. London.

- Kaznesi, A. and Katsarou, S. (1999–2001) Η νεολιθική κεραμική από την Β' Κουβελέικη σπηλιά Αλεποχωρίου Λακωνίας. *Athens Annals of Archaeology* 32–34, 28–36.
- Katsarou, S. (2017). Beyond transition: tracing eventfulness behind the Middle Neolithic-Late Neolithic I ceramic divide. In S. Dietz, F. Mavridis and J. Tankosiz (eds) *Communities in Transition. The Circum-Aegean Area in the 5th and 4th Millennia BC*. Oxford.
- Katsarou, S. and Sampson, A. (1997) Φάσεις I–III. Η νεολιθική κεραμική. In A. Sampson *Το σπήλαιο των Λιμνών στα Καστριά Καλαβρύτων. Μια προϊστορική θέση στην ορεινή Πελοπόννησο*, 77–273. (Society of Peloponnesian Studies 7). Athens.
- Katsarou-Tzeveleki, S. (2008) Early Neolithic weavers paint. Youra red painted patterns as markers of local group's identity. In A. Sampson (ed.) *The Cave of Cyclops on the Island of Youra, Greece. Mesolithic and Neolithic Networks in the Northern Aegean Basin. I. Intra-Site Analysis, Local Industries and Regional Site Distribution*, 69–110. Philadelphia.
- Koumouzelis, M. (1989) Η κεραμική από την «Α' Κουβελέικη Σπηλιά» Αλεποχωρίου Λακωνίας. *Athens Annals of Archaeology* 22, 143–160.
- Kuijt, I. (2008) The regeneration of life: Neolithic structures of symbolic remembering and forgetting. *Current Anthropology* 49, 171–197.
- Lambert, N. (1972) Grotte d'Alépotrypa (Magne). *Bulletin de correspondance hellénique* 96, 845–871.
- Laneri, N. (2007) An archaeology of funerary rituals. In N. Laneri (ed.) *Performing Death. Social Analysis of Funerary Traditions in the Ancient Near East and Mediterranean*, 1–13. Chicago.
- Last, J. (2006) Potted histories: Towards an understanding of potsherds and their contexts. In D. Papaconstantinou (ed.) *Deconstructing Context. A Critical Approach to Archaeological Practice*, 120–137. Oxford.
- Mavridis, T. and Sørensen, L. (2006) The site of Pangali, Mt. Varassova in Aitolia, and the Late Neolithic Ib in the Aegean: social transformations and changing ideology. In S. Dietz and I. Moschos (eds) *Chalkis Aitolias I. The Prehistoric Periods*, 117–170. (Monographs of the Danish Institute at Athens 7). Århus.
- Mee, C. (2009a) Cohesion and diversity in the Neolithic Peloponnese: what the pottery tells us. In W. G. Cavanagh and S. Hodkinson (eds) *Being Peloponnesian: Conference Proceedings 31 March–1 April 2007*. (Centre for Spartan and Peloponnesian Studies online publication).
- Mee, C. (2009b) Interconnectivity in Early Helladic Laconia. In W. G. Cavanagh, C. Gallou and M. Georgiadis (eds) *Sparta in Laconia. From Prehistory to Pre-Modern. Proceedings of the Conference Held in Sparta, Organised by the British School at Athens, the University of Nottingham, the 5th Ephoreia of Prehistoric and Classical Antiquities and the 5th Ephoreia of Byzantine Antiquities, 17–20 March 2005*, 21–28. (British School at Athens Studies 16). London.
- Mee, C. (2014) The Late Neolithic rhyta from Kouphovouno in the Peloponnese, Greece. *Journal of Prehistoric Religion* 24, 7–18.
- Metcalf, P. and Huntington, R. (1991) *Celebrations of Death. The Anthropology of Mortuary Ritual*, 2nd edition. Cambridge.
- Moxey, K. (2008) Visual studies and the iconic turn. *Journal of Visual Culture* 7, 131–146.
- Özdoğan, A. (1999) Çayönü. In M. Özdoğan and N. Başgelen (eds) *Neolithic in Turkey: The Cradle of Civilization. New Discoveries*, 35–63. Istanbul.
- Palaiologos, D. and Stefanopoulou, M. in press. Η προϊστορική τοπογραφία στη βόρεια Αττική: Πρόσφατες ανακαλύψεις. In *Athens and Attica in Prehistory. Proceedings of International Conference, Athens, 27–31 May, 2015*.
- Papathanasiou, A. (2001) *A Bioarchaeological Analysis of Neolithic Alepotrypa Cave, Greece*. (British Archaeological Reports S961). Oxford.
- Papathanasiou, A. (2009) Mortuary behaviour in the Alepotrypa cave: assessments from the study of the human osteological material. In W. G. Cavanagh, C. Gallou and M. Georgiadis (eds) *Sparta in Laconia. From Prehistory to Pre-Modern. Proceedings of the Conference Held in Sparta, Organised by the British School at Athens, the University of Nottingham, the 5th Ephoreia of Prehistoric and Classical Antiquities and the 5th Ephoreia of Byzantine Antiquities, 17–20 March 2005*, 21–27. (British School at Athens Studies 16). London.
- Papathanassopoulos, G. A. (1996) *Neolithic Culture in Greece*. Athens.
- Papathanassopoulos, G. A. (1971) Σπήλαια Διρού, 1971. *Athens Annals of Archaeology* 4, 289–304.
- Papathanassopoulos, G. A. (2011) *Το Νεολιθικό Διρό: Σπήλαιο Αλεπότρυπα*. Athens.
- Pappa, M., Halstead, P., Kotsakis, K. and Urem-Kotsou, D. (2004) Evidence for large-scale feasting at Late Neolithic Makriyalos, northern Greece. In P. Halstead and J. C. Barrett (eds) *Food, Cuisine and Society in Prehistoric Greece*, 16–44. (Sheffield Studies in Aegean Archaeology 5). Oxford.
- Parker Pearson, M. (1999) *The Archaeology of Death and Burial*. Stroud.
- Perlès, C. (2001) *The Early Neolithic in Greece*. Cambridge.
- Perlès, C. and Vitelli, K. D. (1999) Craft specialization in the Neolithic of Greece. In P. Halstead (ed.) *Neolithic Society in Greece*, 96–107. (Sheffield Studies in Aegean Archaeology 2). Sheffield.
- Petrakis, S. L. (2002) *Ayioryitika. The 1928 Excavations of Carl Blegen at a Neolithic to Early Helladic Settlement in Arcadia*. (Prehistory Monographs 3). Philadelphia.
- Phelps, W. W. (2004) *The Neolithic Pottery Sequence in Southern Greece*. (British Archaeological Report S1259). Oxford.
- Psimogiannou, A. (2008) *Η νεολιθική εγκατάσταση στον Προσκυνά Φθιώτιδας*. Unpublished Masters thesis, Aristotle University of Thessaloniki.
- Pullen, D. J. (2011) *The Early Bronze Age Village on Tsoungiza Hill. Nemea Valley Archaeological Project 1*. Princeton.
- Relke, J. R. (2007). Interpreting the bucrania of Çatalhöyük: James Mellaart, Dorothy Cameron and beyond. *Anthrozoos: a Multidisciplinary Journal of the Interactions of People and Animals* 20, 317–328.
- Robb, J. (2002) Time and biography. Osteobiography of the Italian Neolithic lifespan. In Y. Hamilakis, M. Pluciennik and S. Tarlow (eds) *Thinking Through the Body: Archaeologies of Corporeality*, 153–171. London.
- Robb, J. (2007) Burial treatment as transformation of bodily ideology. In N. Laneri (ed.) *Performing Death. Social Analysis of Funerary Traditions in the Ancient Near East and Mediterranean*, 287–297. Chicago.

- Rodden, R. J. (1962) Excavation at the Early Neolithic site at Nea Nikomedeia, Greek Macedonia (1961 season). *Proceedings of Prehistoric Society* 28, 267–288.
- Sampson, A. (1988) *Η Νεολιθική κατοίκηση στο Γυαλί της Νισύρου*. Athens.
- Sampson, A. (1993) *Σκοτεινή Θαρρουνίων. Το σπήλαιο, ο οικισμός και το νεκροταφείο*. Athens.
- Sampson, A. (2008) *The Sarakenos Cave at Akraephnion, Boeotia, Greece, I: The Neolithic and the Bronze Age*. Athens.
- Saville, A. (1990) *Hazleton North: The Excavation of a Neolithic Long Cairn of the Cotswold-Severn Group*. London.
- Schoep, I. and Tomkins, P. (2016) 'Death is not the end'. Tracing the manipulation of bodies and other materials in the Early and Middle Minoan cemetery at Sissi. In M. Boyd and A. Dakouri-Hild (eds) *Staging Death: Funerary Performance, Architecture and Landscape in the Ancient Mediterranean*, 227–252. Cambridge.
- Shanks, M. and Tilley, C. (1982) Ideology, symbolic power and ritual communication: a reinterpretation of Neolithic mortuary practices. In I. Hodder (ed.) *Symbolic and Structural Archaeology*, 129–154. Cambridge.
- Skourtopoulou, K. (2006) Questioning spatial contexts: The contribution of lithics studies as analytical and interpretative bodies of data. In D. Papaconstantinou (ed.) *Deconstructing Context: A Critical Approach to Archaeological Practice*, 50–78. Oxford.
- Stroulia, A. and Chondrou, D. (2013) Destroying the means of production: the case of ground stone tools from Kremasti-Kilada, Greece. In J. Driessen (ed.) *Destruction: Archaeological, Philological and Historical Perspectives*, 109–132. Louvain.
- Syriopoulos, K. T. (1964) *Η προϊστορία της Πελοποννήσου*. (Βιβλιοθήκη της εν Αθήναις Αρχαιολογικής Εταιρείας 51). Athens.
- Tainter, J. A. (1978) Mortuary practices and the study of prehistoric social systems. In M. B. Schiffer (ed.) *Advances in Archaeological Method and Theory* 1, 105–141. New York.
- Talalay, L. E. (1987) Rethinking the function of clay figurine legs from Neolithic Greece: an argument by analogy. *American Journal of Archaeology* 91, 161–169.
- Talalay, L. E. (2004) Heady business: skulls, heads and decapitation in Neolithic Anatolia and Greece. *Journal of Mediterranean Archaeology* 17, 139–163.
- Thomas, J. (2000) Death, identity and the body in Neolithic Britain. *Journal of the Royal Anthropological Institute* 6, 653–668.
- Todaro, S. (2012) Human remains at FN Phaistos: identifying and interpreting practices of disposal and manipulation of the dead from an archaeological perspective. *Creta Antica* 13, 13–39.
- Triantafyllou, S. (2008) Living with the dead: a re-consideration of mortuary practices in the Greek Neolithic. In V. Isaakidou and P. Tomkins (eds) *Escaping the Labyrinth: The Cretan Neolithic in Context*, 139–157. (Sheffield Studies in Aegean Archaeology 8). Oxford.
- Tzevelekidi, V. (2012) *Dressing for Dinner: Butchery and Bone Deposition at Late Neolithic Toumba Kremastis-Koiladas, Northern Greece*. (British Archaeological Report S2451). Oxford.
- Ucko, P. J. (1969) Ethnography and archaeological interpretation of funerary remains. *World Archaeology* 1, 262–280.
- Urem-Kotsou, D. (2006) *Νεολιθική κεραμική του Μακρυγιάλου: Διατροφικές συνήθειες και οι κοινωνικές διαστάσεις της κεραμικής*. Unpublished PhD thesis, University of Thessaloniki.
- Vitelli, K. D. (1993) *Franchthi Neolithic Pottery, 1. Classification and Ceramic Phases 1 and 2*. (Excavations at Franchthi Cave, Greece, fascicle 8). Bloomington.
- Vitelli, K. D. (1999) *Franchthi Neolithic Pottery, 2. The Later Neolithic Ceramic Phases 3 to 5*. (Excavations at Franchthi Cave, Greece, fascicle 10). Bloomington.
- Vitelli, K. D. (2007) *The Neolithic Pottery from Lerna*. (Lerna V). Princeton.
- Waterhouse, H. and Hope-Simpson, R. (1960) Prehistoric Laconia: Part I. *Annual of the British School at Athens* 55, 67–107.
- Waterhouse, H. and Hope-Simpson, R. (1961) Prehistoric Laconia: Part II. *Annual of the British School at Athens* 56, 114–175.
- Zachos, K. L. (2008) *Ayios Dhimitrios: A Prehistoric Settlement in the Southwestern Peloponnese. The Neolithic and Early Helladic Periods*. (British Archaeological Reports S1770). Oxford.

Appendix 5.1. Ossuary II. Correlation of potsherd registers cited with excavation units

<i>No.</i>	<i>Square</i>	<i>No.</i>	<i>Square</i>
70	fIV	144	eIII
71	fIII	145	cIII
72	dIII	146	dIII
73	gII	147	cIII
74	dIII	149	gII
75	eIV	151	dIII
76	fIII	153	dIV or gII
78	fIII	154	dIII
91	cIII	174	dIV?
102	eIV	176	dIV?
104	dIII	177	dIII
106	dIII	178	dIII
107	dIII	179	dIII
108	eIV	180	dIII
110	fIII	183	dIII
114	fIII	184	dIII
125	fIII	210	cIII
129	dIV	211	eIII
133	dIV	212	eIII
141	dIII	213	fIII
142	dIII	214	dIII
143	fIII		

Patterns of pottery consumption, destruction and deposition at Alepotrypa Cave: the case of Chamber Z during the Neolithic period

Katerina Psimogiannou

No matter how “like” Us they may be thought to be, ultimately the dead are not-Us ... The dead are the Other...
Helms 1998, 27

Introduction

Alepotrypa Cave, which has been systematically excavated since the early 1970s under the direction of Dr Giorgos Papathanassopoulos, constitutes one of the most intriguing prehistoric sites of southern Greece. Several factors contribute to this: the natural formation of the cave comprising several small chambers, ending in a deep freshwater lake; its geographical locus which enables access both to the Greek mainland and the Aegean; the wide range of mortuary practices attested; the quantities of human osteological material; and above all the variety and state of preservation of artefacts deposited and remaining sealed until the discovery of Alepotrypa by a team of speleologists in the 1950s (see Papathanasiou, Chapter 2).

Our archaeological knowledge concerning this cave has been based upon several preliminary reports (Papathanassopoulos 1971, 1992, 1996b, 1996c, 2011; Lambert 1972). Extensive discussion has taken place regarding burial practices and human skeletal remains uncovered by the excavations that took place until the 1990s (Papathanasiou 1999, 2001, 2009). Phelps’s presentation and discussion of part of the pottery (1975, 2004) has long been a valued contribution; only a few related works have appeared since then (*e.g.*, Karali 1998; Rammou 2009). But a thorough chronological, stratigraphic and contextual review of the human activities represented in this cave has been lacking, and a vague portrait was the result.

Human activity at the site was established in the later phase of the Early Neolithic (end of the 7th millennium BC) with the deposition of human burials, according to new radiocarbon dates from Ossuary 1, Trench B1 and Chamber Z (see Papathanasiou, Chapter 2, Table 2.1), and continued, although with probably a few breaks (Karkanas, this volume), for thousands of years within the Neolithic era (Papathanasiou, Chapter 2 for radiocarbon dates). It is important to note that every human activity in the cave was sealed by the prehistoric people themselves by a number of means (*e.g.*, fires, stones, clay surfaces; see Karkanas this volume), and then at the end of its life by a final layer of stalagmitic material. As a result Alepotrypa Cave has yielded an enormous quantity of well-preserved archaeological assemblages.

This paper focuses on a specific part of the cave, one of the innermost and darkest, called Chamber Z (for location, see CPI 3).¹ An initial attempt is made to re-contextualise the material culture found in this area, to prepare the way for a fuller publication of the pottery, and to re-examine the chronology of the cave’s use. The aims are first to present the archaeological evidence unearthed in this chamber and second to discuss the human practices and choices attested. Emphasis is given to the pottery in this process, specifically on presenting what was deposited, and how and when: the new radiocarbon dates are vital here as one tries to place activities into the archaeological, cultural and chronological contexts both of

the cave and of the Neolithic of southern Greece. Taking into consideration recent archaeological theory regarding mortuary practices, the use of space, and material culture, the evidence from Alepotrypa Cave can be incorporated into the broader archaeological discussions concerning the Aegean and the Balkan Neolithic. This study also serves to illustrate the importance of caves and their role in human social dialogue, as active parts of the natural and cultural landscapes to which they belong (Tilley 1994; Thomas 2001).

Neolithic cave archaeology in central and southern Greece: a brief overview

The Neolithic period in central and southern Greece witnessed an extensive and intense use of caves, especially during its last phases. The Late (5,400/5,300–4,500/4,300 cal BC) and Final Neolithic (4,500/4,300–3,100/3,000 cal BC) periods² (hereafter LN and FN respectively) in the southern Greek mainland and the Aegean are thought to mark a time of settlement expansion, accompanied by a dispersion of small sites in the landscape and a colonisation of marginal environments (van Andel and Runnels 1988; Halstead 1994). The intensification of cave usage at the end of the period (Diamant 1974; Wickens 1986) has been considered to have come about as a result of this general change in settlement patterns, which most surface surveys and especially those in the Peloponnese seem to indicate. Economic, demographic and climatic changes, as well as the intensified exchange and trade networks among the communities of the Aegean, have been put forward as explanations for this new way of life. Population growth, dispersal into small farmsteads and hamlets or special-purpose sites, a shift in modes of production and transhumant pastoralism are thought to characterise the southern Greek landscape during these periods (van Andel *et al.* 1986; van Andel and Runnels 1988; Runnels and van Andel 1987; Wells *et al.* 1990). Caves were thus believed to have been occupied on a seasonal basis by mobile pastoralist groups (van Andel and Runnels 1988, 242–245; Papathanassopoulos 1996a, 40; see also discussion in Dousougli 1998, 145–154).

Interpretation of cave usage has followed the archaeological principles and prejudices of the day. In many cases, however, these interpretations have been based not on a contextual study of the evidence, but on modern biases or on individual features present: thus human burials indicate a burial cave, figurines indicate ritual practices, pithoid vessels and pits imply a storage area, etc. (see the discussion in Stratouli 1998, 60–61). Most archaeologists used to interpret artefacts and other kinds of material culture in caves (*e.g.*, pottery, animal bones, lithics) as purely domestic assemblages (Papathanassopoulos 1996b, 39–40; Zachos 1998, 56), because they so often were made up from household

objects. In cases of mortuary contexts, ritual or burial activity was considered to take place both at the same time as the space was lived in (Papathanassopoulos 1996c, 83), or in periods when caves were not used as habitation areas (Samson 1993, 266). This intermingling of practices has been for years a self-evident explanation of cave usage.

In the last few decades, ceremonial activity has been proposed for Late and Final Neolithic caves in Greece, following the broader tradition for such in the Mediterranean Neolithic (Demoule and Perlès 1993, 404–405). The presence in many caves of prestige or symbolic objects, brought in through exchange networks (*e.g.*, metals, Spondylus bracelets), eventually led some scholars to claim that caves might have been places of intentional and ritual deposition, thereby taking specific items out of circulation (Nakou 1995, 6–7; Broodbank 2000, 165). Recently, most of the previous interpretations of the use of Neolithic caves in the southern Aegean, including those on Crete, were thoroughly investigated by Tomkins (2009, 2012). He challenged the domestic model of caves: his broad-based discussion took in their location, their material record and the practices attested therein. In conclusion, he (Tomkins 2009, 138) stressed the importance of Neolithic caves as ritual and central places for interaction and exchange, “regional or supra-regional arenas” (Tomkins 2009, 146) for consumption, negotiation of status and identities (see also Nakou 1995, 21–22).

The role of caves as places for social and ritual gatherings has also been discussed by Vitelli (1993; 1999) in the case of Franchthi Cave, as well as by Stratouli (2005) for the Drakaina cave on Kephallonia. This pattern was further related to a ‘low visibility’ of settlements during the Late Neolithic in southern Greece (Vitelli 1999, 100). As has been extensively discussed by Vitelli (1999), based on the evidence from the Franchthi cave and the Southern Argolid in general, where a lack of settlement remains during that period is attested, the LN people in southern Greece are represented by distinctive pottery wares (*e.g.*, matt-painted, black burnished, *etc.*) and other artefacts that make them visible at special sites (usually caves), where they gathered for particular occasions and for short-term visits. During their activities at these places they used the distinctive pottery assemblages, so creating the ceramic remains by which we recognise the Late Neolithic period in the region (Vitelli 1999, 100–102; 2007, 115–116).

The archaeological picture does not seem to be very different for the Final Neolithic either. A review of the archaeological record of the period in southern Greece has shown that mortuary contexts (*e.g.*, Kephala Kea, Athens North slope, *etc.*) dominated until now (Psimogiannou 2012, 2015), with little in the way of architectural remains (*e.g.*, Strophylas Andros). In this context, many caves that were used during the FN, such as Alepotrypa, were suggested to have served as a locus of communication and integration of social groups using a more dispersed and fluid/ephemeral model of habitation (Psimogiannou 2012,

2015), as is attested in the whole southern Aegean during the FN period (see further discussions in Halstead 1995; Vitelli 1999, 103; Broodbank 2000, 154, 174; Tomkins and Schoep 2010, 73–75; Schoep and Tomkins 2012, 6; Tomkins 2014). Of special interest is the presence of FN burials even outside of some caves, such as at Franchthi (Vitelli 1999, 98) and now also at Alepotrypa (Papathanasiou *et al.* 2013; Parkinson *et al.* 2015), a practice that has to wait for further investigation in the future, in relation to the broader social and settlement pattern of the FN period.

In summary, many of the above discussions offered new interpretations and approaches regarding cave usage, their features and the materials they contain; they demand the inclusion of caves as integral parts of the broader cultural, chronological and social landscape of the Neolithic period in southern Greece. At the same time, we have to keep in mind that each Neolithic cave, as indeed every prehistoric site, is unique – with its own discrete characteristics that distinguish it from all others. Each cave has its own history and biography, depending on the precise times and processes (human or natural) of its use, through the specific human activities and (re) visits it experienced. Thus, each should be treated as an individual case, analysed and examined in the context of its region, its cultural and chronological backgrounds.

Chamber Z of Alepotrypa Cave

The setting

Chamber Z is one of the innermost parts of Alepotrypa Cave, which ends in a freshwater lake (see map, Figure 0.1). It is the one of the darkest³ places of the cave, and certainly the most claustrophobic. It had immediately attracted the interest of the speleologists who first entered Alepotrypa, partly because of the presence of the water, but also because of an extensive thick, black stratum that covered the whole surface of this area, in which human bones were discernible (Petrocheilos 1958). After recent analysis, this black stratum, which still remains visible and unexcavated over a large part of this chamber, has been identified as burnt dung that had been brought into the cave (Tsartsidou, this volume; Karkanas, this volume).

To reach Chamber Z from the entrance of the cave (as it is defined today) visitors must first traverse nearly half the length of the cave, passing by several small natural chambers, called niches, where human burials and other kinds of material remains were once deposited. These have now been excavated (*e.g.*, the Niche of the Amphora, Ossuary II, etc.; see Papathanassopoulos 2011; Papathanasiou, Chapter 2). Thereafter the access becomes more difficult, by modern standards at least, since one has to go through a long and constricted passage, which in prehistoric times must have been even narrower (the passage was widened during construction works in the 1960s). We have to point out here that, no matter how fluent our verbal description may be, it is impossible to convey

on paper the ambience of a cave and the impact it would have had. And this last would surely have been an important component of the practices carried out there, especially in producing visionary experiences. One must visit and experience in person the cave in order to understand and feel the evocative atmosphere it creates through its stalagmites and stalactites, its wet environment and the utter darkness.

Chamber Z is made up of three small natural niches, called 31 (Figure 6.1; TH31/LA1 on map, Figure 0.1 and Figure 2.7), 22 (Figure 6.2; TH22/Z22 on map, Figure 0.1 and Figure 2.6), and 22a (Figure 6.3; TH22a/Z22a on map, Figure 0.1 and Figure 2.6) by the excavator. A more open area next to them (Θ 20, Figure 6.4; TH20 on map, Figure 0.1 and Figure 2.6) is still covered by the black, greasy material of the dung that remains unexcavated. Opposite them (Θ 24, CPII 5; TH24 on map, Figure 0.1 and Figure 2.6) are also other parts of Chamber Z, sited exactly before the entrance to the huge Chamber of the Lakes. The access to the latter is accomplished down a staircase cut into the bedrock, which has been interpreted as a construction of the Neolithic period by the excavator (Papathanassopoulos 2011, 50). Niches 22 and 22a are set side by side, with Niche 31 a few metres away to the east. Part of the open area (Θ 24) in front of the three niches was disturbed when a cement corridor was constructed over the prehistoric deposits during the 1960s. The deposits of the three niches, however, remained intact and undisturbed until their excavation.⁴

The archaeological and chronological context

Excavation within Chamber Z was undertaken at different times: during the 1980s (Niche 31), the 1990s, between 2000 and 2006 and again in 2013 (Niches 22, 22a, Θ 24). The human osteological material found in this area had not been included in the earlier analysis of burial practices elsewhere in the cave (Papathanasiou 1999; 2001); they are currently under study. In this paper a few preliminary remarks will be presented from this research, with particular reference to material from the three niches.

The overwhelming characteristic of this area beside the burnt dung is the enormous quantity of vessels it produced. A selection of the pottery and other artefacts has been presented in preliminary works (*e.g.*, Papathanassopoulos 1996c, 216–229; 2011).

The use of Chamber Z started in a late phase of the Early Neolithic (hereafter EN), according to a dung sample dated to 6,070–5,920 cal BC (OxA-29788; 7,128 ± 34 BP). This date accords with the rest of the cave, according to the recent radiocarbon dating of human burials in Trench B1 (lowest deposit) and Ossuary I (Papathanasiou, Chapter 2; Karkanas, this volume). Pottery of a late EN date from the cave had also been recognised in the past by Phelps during his visit (Phelps 2004, 12), though its location is uncertain. In Chamber Z, the EN is represented by only a few sherds (*e.g.*, Figure 6.13a, b, c).

Its use continued, probably sporadically, for part of the Middle Neolithic (*c.* 5,800/5,600–5,400/5,300 cal BC;

hereafter MN), in its middle and late phases. This time span cannot be defined precisely at the moment; it is based only on the relative chronology and the pottery found. However, this seems to correspond to the chronological sequence as shown in the stratigraphy of Trench B1 (Karkanas, this volume; Katsipanou, this volume). The same holds for the LN period, represented in Chamber Z by characteristic pottery wares (*e.g.*, Black-on-Red, Black Burnished, Grey Burnished, etc.). No radiocarbon dates from the MN and the LN have yet been retrieved from this area (see further discussion below). New radiocarbon dates on scattered human bones from Chamber Z, however, have produced dates of the Final Neolithic period (4230–3960 cal BC, 3980–3800 cal BC and 3980–3800 cal BC; OxA-29206, 29204, 29205; see Table 2.1), consistent with pottery attributed to the same period. This evidence again matches that from the rest of the cave, in particular the stratigraphy of Trench B1 (see below).

Niche 31

Niche 31 (Figure 6.1; TH31/LA1 on map, Figure 0.1 and Figure 2.7) is situated at the east part of this area, immediately in front of the large Chamber of the Lakes. It looks like a hole in the rock-wall of the cave. Its interior dimensions are up to 1.76 m in length and almost 1 m in

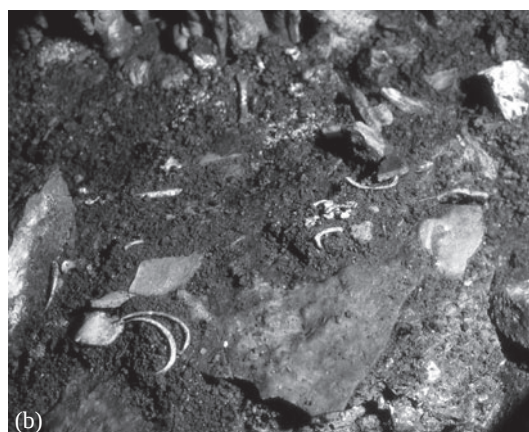


Figure 6.1. a) Niche 31 during excavation; b) detail of interior (G. A. Papathanassopoulos archives).

height, while its opening/mouth ranges in height from 0.47 m to 0.70 m. In the interior of Niche 31, a deposit of 0.20 m depth bearing intense traces of burning was excavated: it yielded pottery, human and animal bones, obsidian blades, shells, shell beads, etc. On its surface many pieces of broken vessels were discernible. The niche interior was excavated in three layers: OM 215: surface collection of red monochrome broken pots, with fragmentary skeletal remains of two children of one-and-a-half and three-and-a-half years old (Papathanasiou, Chapter 13) found underneath the pots; OM 216: second layer of dark soil with pottery similar to the one found on the upper layer and a few human bones; OM 217: lowest layer/bedrock deposit of black greasy soil full of painted pottery in a very fragmentary state of preservation, no human bone. Flat pieces of stalagmite material were deliberately deposited there to cover the surface of the bedrock.

The uppermost layer produced large parts of vessels and sherds belonging to the FN period, according to relative and absolute chronology. Many of the vessels and sherds found at the top of this deposit were covered with a stalagmitic concretion deposited from the cave's ceiling and walls and that had gradually accumulated on their surface (see Papathanassopoulos 1996c, 176, figs 48–49). The majority of the FN pottery of this layer is red monochrome collar jars of a coarse or medium-coarse fabric, most of them bearing tubular lugs on their body and grey traces on their outer surface (Figure 6.5a–d; CPII 6 and 7). To the same period can be dated parts of a deep bowl, a base of a likely baking pan (Figure 6.6a), a complete slender and low solid foot (Figure 6.6b), a pithoid vessel (Figure 6.6c), and seven red monochrome coarse/medium-coarse open bowls (Figure 6.7a–d) of various profiles and surface treatment. Underneath these broken pots several isolated human bones of small size were found. In one case two children's teeth were found set on the inside surface of a large sherd and mixed with soil, charcoal and ashes, while in another case the major part of a child's jaw was again found placed inside a big sherd. In the same deposit other small parts of a child's skull were found.

Although in previous reports these burials had been mentioned as products of cremations (Papathanassopoulos 2011, 64; 1996c, 176), it is important to note that they are in fact acts of secondary burial deposition (Papathanasiou, Chapter 13). Part of the skeletons of the two young children had been brought from their original burial context and deposited at some point in Niche 31. According to a recent radiocarbon dating on one of these two secondary child burials, the date generated was 4015 ± 27 cal BC (OxA-29206; 5213 ± 32 BP), *i.e.*, to the FN period.

The second layer contained black soil and less ceramic material, mostly red monochrome pots again, as well as a few fragments of a child's skull. The majority of the painted pottery was found in the lowest layer (OM 217) and on the bedrock of the niche; the lowest layer comprised the black greasy material. This earlier pottery material seems

to belong to the late EN or MN (*e.g.*, Figure 6.8a, b, c), the late MN (*e.g.*, monochrome Urfirnis low-collar jar, see Figure 6.17b and Papathanassopoulos 2011, 200, fig. 147), the very beginning of the LN (*e.g.*, Black Burnished ware) as attested elsewhere in the cave (see pottery and radiocarbon dates from Trench B1), and to the LN period proper (*i.e.*, a large quantity of sherds and collars from vessels in Matt Painted ware, and but one part of a collar jar in Polychrome ware; Figure 6.9; CPII 8 and 9).

Niche 22

Niche 22 (also called Θ 22 or Z22) is another natural chamber in the rock wall of the cave (Figure 6.2; TH22/Z22 on map, Figure 0.1 and Figure 2.6), but larger in dimensions than Niche 31. The width at its entrance is up to 1.50 m, while its depth is over 4 m. However, to reach the rear of the niche one has to crawl: the height of the ceiling steadily diminishes, from 1.05 m at the opening, through 0.68 m at its centre to 0.20 m and less at the very end. The interior of the niche produced a stratum comprising several thousand sherds (see also Papathanassopoulos 1996, 176, fig 47), as well as some human and animal bones, lithics and other finds, found in the same black, greasy material that still covers the rest of area Z (Θ 20, Θ 24), alternating with a more brown and clayish stratum. The deposit generally was 0.20–0.50 m thick, but at its far end it dropped to a mere 0.03–0.05

m, made up in fact of only a few sherds of monochrome pottery lying on the bedrock. From this deposit a human bone was collected, dated to 3892 ± 64 cal BC (Ox-A 29205; 5108 ± 32 BP), while a partial subadult skull was also found nearby and further in, also directly on bedrock (square 91). Scattered human remains were retrieved yet further inside (Papathanasiou *et al.* 2013). The roof of the niche at this point is only 0.20 cm above the bedrock base.

As in Niche 31, the deposit was not so much made up of soil, as of pottery sherds very tightly packed, one right on top of another. Articulated burials were not retrieved here, only dispersed human bones (Papathanasiou, Chapter 13). The upper layer of the niche contained mostly red monochrome pottery covered also with naturally formed stalagmitic matter (Figure 6.10a, b), as seen in Niche 31. This coating is an indication that the pottery remained undisturbed and *in situ* for many years (Karkanas, pers. comm.). In contrast, the sherds that were found underneath were clean, since they were protected by all those lying above.

The monochrome pottery from the upper layer belongs to the FN period, according to both relative and absolute chronologies. It includes lugs, bases, and body sherds with tubular lugs (Figure 6.11a, b); most of the sherds belong to collar jars, similar to those found in Niche 31. Only a few open vessels may occur (*e.g.*, part of a rolled-rim large bowl, Figure 6.22c). The layer of sherds underneath produced more painted pottery of the Matt Painted and Polychrome wares, mostly sherds from collar jars and only a few bowls. To the same context belong also wares that could be attributed to earlier Neolithic periods, such as the late EN or the MN period, such as some red slipped and burnished sherds (Figure 6.12a, b), one red slipped lug with pattern-burnished decoration (Figure 6.12c; see similar examples in Papathanassopoulos 1996, 257, fig. 106 from MN Thessaly), a vertical lug from a bowl (Figure 6.12d, see Vitelli 2007, 191, fig. 3h), and so on.

Niche 22a

Niche 22a (also called Θ 22a or Z22a) (Figure 6.3) is situated right next to Niche 22 (TH22A/Z22A on map, Figure 0.1 and Figure 2.6), but is of smaller dimensions. The height of the niche ranges from 0.93 m to 1.30 m; the opening at its entrance is 0.92 m high, though it is not as deep as Niche 22 (up to 1.50 m long). In the interior a thick stratum was excavated which produced a large amount of pottery, human and animal bones and other finds, all within a black, burnt, greasy material. The thickness of this stratum, as also noticed in Niche 22, was least at the far end of the niche (0.07–0.10 m), though at some points at its centre it was up to 0.80 m. Pottery sherds were again found tightly packed together, one above the other. At the top, the pottery was mostly monochrome and covered with stalagmitic matter, as in Niches 22 and 31. It can be dated to the FN period and includes once more red monochrome pots. The layer underneath and closer to the

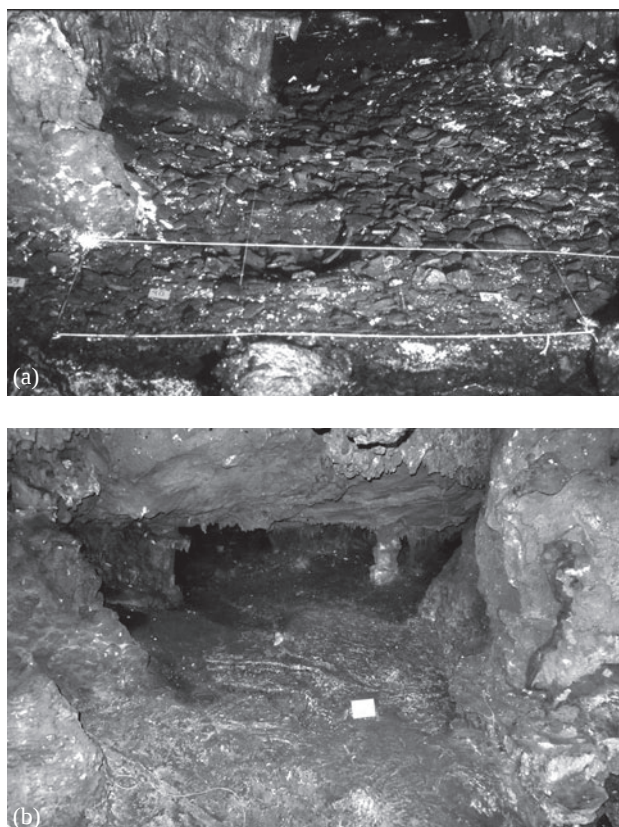


Figure 6.2. Niche 22 (a) before (by George Valvis) and (b) after excavation (by Panagiotis Karkanas).



Figure 6.3. Niche 22a after excavation (by Panagiotis Karkanas).

bedrock of the niche produced large quantities of painted pottery, according to excavation journals (see pottery in Matt Painted ware from Niche 22a in Papathanassopoulos 2011, 190, 194, and part of a black burnished bowl with white paint in Papathanassopoulos 2011, 188). Moreover it yielded pottery that can be attributed to earlier Neolithic periods. Eight joining body sherds from a patterned Urfirnis closed vessel (CPII 11 and 13), the largest part of which (Papathanassopoulos 1996, 220, fig. 24) was found at the entrance of the nearby Niche 22, came also from this layer.

Θ 24

A large amount of pottery and other artefacts was retrieved in the area opposite (Θ 24) and outside these niches (*i.e.*, under the modern cement corridor which was constructed exactly above them during the 1960s; TH24 on map, Figure 0.1 and Figure 2.6). Due to construction work conducted there, the original archaeological circumstances can no longer be reconstructed. It is important to note though that the pottery from Θ 24 exhibits an excellent state of preservation. For example, at the entrance to Niche 22 (outside of it), where the natural bedrock slopes down steeply, several kinds of pottery vessels were uncovered, including a large part of a pattern-painted Urfirnis low-collar jar (CPII 11, and Papathanassopoulos 1996, 220, fig. 24), some pots of Black and Grey Burnished ware, and a jar of Black-on-Red ware (CPII 12, and Papathanassopoulos 1996, 219, fig. 23), all covered with the black dung.

At the time of the touristic development of the cave in the 1960s, this particular part of Chamber Z was extensively used by workmen; accordingly the stratigraphy in its upper part is not clear. In later excavation seasons (during the 2000s), the prehistoric deposit was dug down to the bedrock; it varies from 0.20 m to 0.40 m in thickness. The stratigraphy of the excavated area presented a picture similar to the one of other niches of the cave (*e.g.*, Θ 14, excavated 2013), with hard clay surfaces alternating with the black stratum (see also Tsartsidou, this volume;



Figure 6.4. Θ 20 (by Panagiotis Karkanas).

Karkanas, this volume) that still covers the nearby Θ 20. These surfaces, acting as seals, allowed the preservation of pottery and other material found there (*e.g.*, shell beads from a necklace, see Papathanassopoulos 2011, 27, and lithics, shells, bones, etc.), despite the continuous use of the spot during construction work.

A large amount of pottery has been also recovered in Θ 24 (from both surface collection and subsequent excavation to the bedrock), belonging to several periods of the Neolithic. It comprises material typical of the FN period (*e.g.*, deep open convex bowls, pithoid vessels with holes on the rim, part of a bowl with red crusted decoration (Figure 6.14; CPII 10), ‘fluted bowls’ (Figure 6.15), etc.; see below for more details on the ceramics). The same area has also yielded characteristic LN pottery (*e.g.*, Matt Painted collar jars, a shoulder bowl of the Grey Burnished ware, Figure 6.19a) and other parts of vessels that could be attributed to earlier Neolithic periods (*i.e.*, EN, MN). No complete skeletons were found here, but as with the three niches, only secondary burials (*e.g.* young children inside Niche 31) and isolated skeletal fragments/scatter bone (*e.g.* skull inside Niche 22) have been excavated. The isolated scatter bone could have resulted either from primary or secondary burials elsewhere in the cave or outside of it (see also discussion in Papathanasiou, Chapter 13, this volume). We have to emphasise that the quantity of the human bones from Chamber Z, in comparison with the rest of the cave, is small. Also striking is the complete absence of figurines in Chamber Z; the majority of these in the cave come from the Northern Sector of Chamber B and from Trench B1 in particular.

The pottery assemblage: preliminary remarks on wares, shapes and fabrics

The pottery assemblage studied to date from Chamber Z comes from the three niches and from Θ 24; the open, extended area next to the niches (Θ 20) remains unexcavated. Much of the pottery is still under study and conservation, therefore in this paper only some preliminary remarks will be discussed. They concern: a) the most distinct pottery

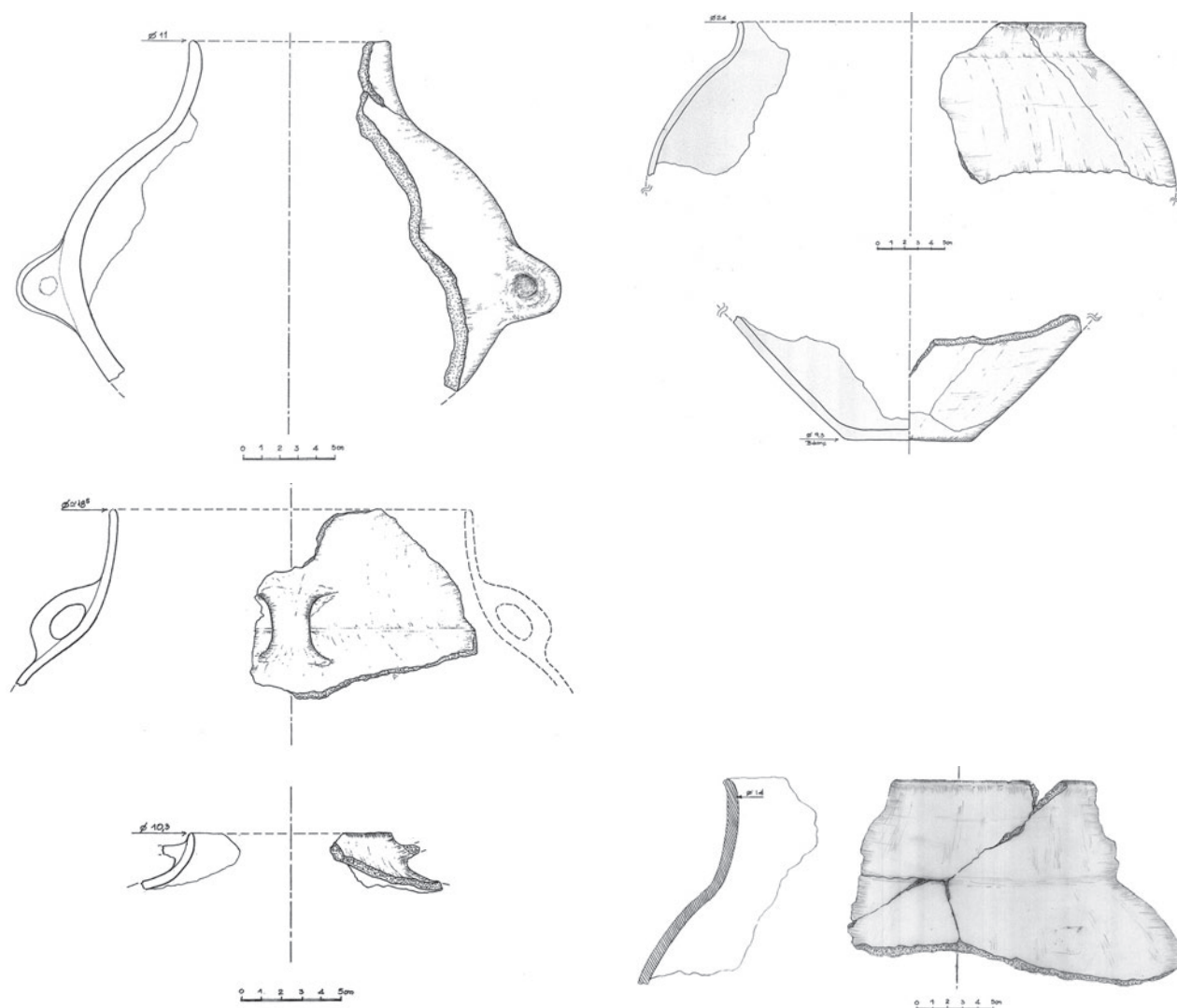


Figure 6.5. FN red monochrome collar jars from Niche 31.

categories, according to the ‘traditional’ classification and chronology relevant to the Neolithic of southern Greece; b) their characteristic shapes, in conjunction with their fabrics, as analyzed by Areti Pentedeka (see Pentedeka, this volume); and c) their consumption and deposition in Chamber Z. The specific quantities of vessels and shapes in every ware cannot yet be estimated.

The pottery classification system of the Neolithic period in southern Greece as it has been defined through the years, especially for its later periods, has a number of deficiencies (see also discussion in Vitelli 1993, 1999 and below in this paper). Due to an absence of stratigraphical sequences, open-air sites and radiocarbon dates, a firm chronology for the area is still lacking. The established system was followed, however, because it served better the purposes of this paper. Only in a few cases has a different terminology been applied (*e.g.*, lime ware, see below).

Lime ware

The basic characteristic of this ware (the term is borrowed from Vitelli 1993, 1999) is the presence of many

calcareous inclusions in the clay (ranging in size up to 3 mm), discernible on the interior and exterior surfaces of the pots. Preliminary examination seems to show that there are mostly closed shapes, usually thin-walled, and in particular collar jars with hemispherical bodies and usually low, vertical necks (Figure 6.16c). Only a few open vessels/bowls appear (Figure 6.16a). Some of the jars also bear incised decoration on their exterior. The surface is usually slipped and burnished (sometimes unburnished), and their colour varies from red (2.5YR 4/6 red) to mostly brown or very dark brown (7.5YR 4/4 brown, 10YR 5/4 yellowish-brown, 10YR 3/3 dark brown on the outside and 10YR 3/1 black, 5/4 yellowish-brown, 5/3 brown – on the interior). In some cases firing clouds occur and sherds are rarely uniform in colour.

Examples of this ware have been found lately in the lower strata of Trench B1, belonging to the layer beneath the multiple human burial, dated to c. 5,400 cal BC. As a consequence, in Chamber Z the ware can also be attributed to a stage of the MN. Some pieces could also belong to a late EN date (see more discussion about EN and MN lime

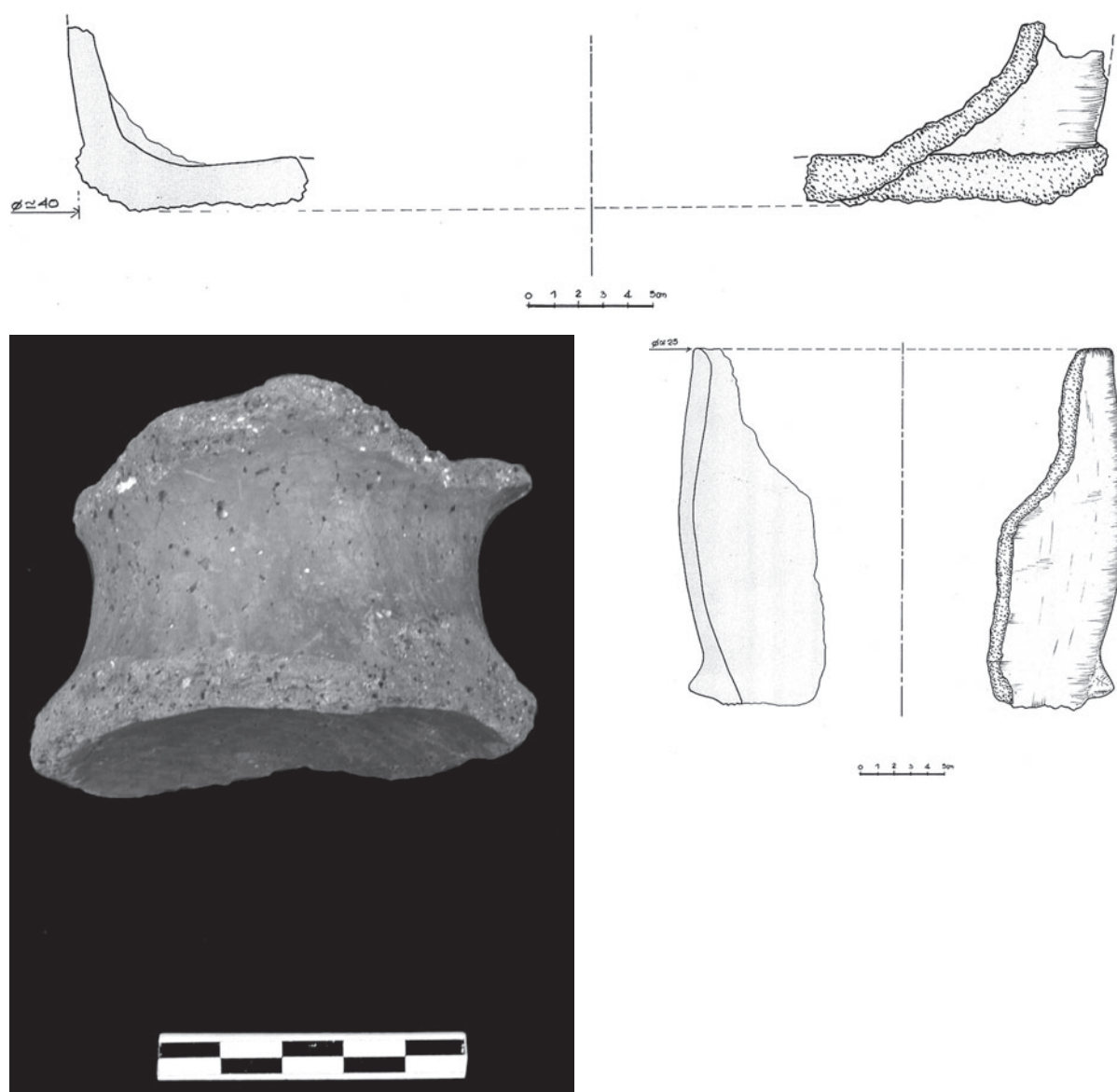


Figure 6.6. Parts of FN red monochrome pottery from Niche 31 (photo by Andreas Heliakopoulos).

ware in Vitelli 1993; 2007, 75–80). Analysis of pottery belonging to clear EN deposits (such as in Ossuary I), unaccompanied by later characteristic MN material (*e.g.*, Urfirnis) will elucidate this issue.

Urfirnis ware

Chamber Z has yielded five Urfirnis vessels (Figure 6.17a–c; CPII 11 and 13). One was found in the interior of Niche 31 (Figure 6.17b), while the others come from elsewhere in the chamber. A few sherds of Urfirnis ware have been recently found in Trench B1, in the deposits below the *c.* 5,400 cal BC human multiple burial (Katsipanou pers. comm. and pers. exam.). Urfirnis ware is mostly found in the Peloponnese and central Greece during the MN, as well as in the early LN (Vitelli 1993, 1999; Phelps 2004, 66; Dousougli 1998, 57–58), in

several contexts, but mostly in caves (*e.g.*, Franchthi and Sarakenos; see Phelps 2004, 61–63), open-air pits (*e.g.*, Elateia, the so-called ‘Bothros’, Weinberg 1962; Eutresis, Caskey and Caskey 1960; Aria, Dousougli 1998, 38), and in a few domestic contexts of the Middle Neolithic (*e.g.*, Lerna, Vitelli 2007; Halai Lokris, Coleman 1992; Facorellis and Coleman 2012; and pers. exam.).

The Urfirnis vessels from Chamber Z belong to closed shapes, with a hemispherical or carinated body with low collars (Figure 6.17b) (see Phelps 2004, 51–52 and figs 19.11, 20.7 and 13). Three of them are pattern painted: Δ14897 (CPII 11), Δ17869 and Δ504 (Figure 6.17c, with black lines creating chevrons on a light ground). The Urfirnis vase (Δ14897, CPII 11), known also as ‘Korona tou Dirou’, *i.e.*, the ‘Crown of Diros’ (see Papathanassopoulos 1996, 220, fig. 24) with its decoration

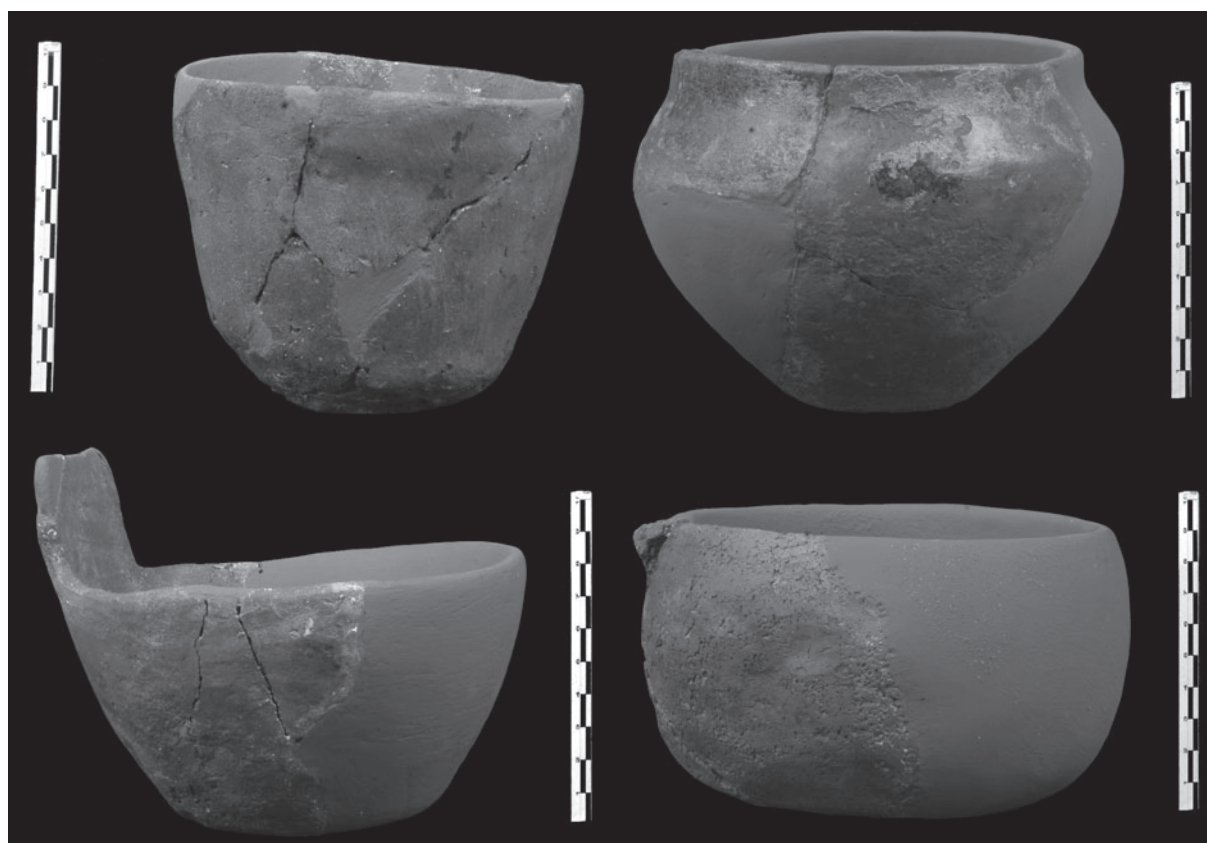


Figure 6.7. Red monochrome bowls from Niche 31 (by Andreas Heliakopoulos).

in dark brown Urfirnis slip has wide-margined multilinear bands in combination with triangles filled with the same dark paint on the body. It bears a plastic decoration of applied small pellets, also painted (Phelps 2004, 60, characterises them as potter's marks). This vessel was found at the entrance of Niche 22, with another body sherd coming from the nearby Niche 22a (CPII 13).

A similar collar jar ($\Delta 17869$, AΔK298; Figure 6.17a) is covered with a black slip around the rim and the belly; pattern-painted decoration with black diagonal bands and lines is placed under the neck (see similar examples in Vitelli 1993, 454, fig. 69e, Late Urfirnis variety; also Phelps 2004, fig. 23.44). It is the only Neolithic piece to date which employs the iron-reduction technique in its manufacture (Pentedeika, this volume). The other two Urfirnis vessels bear only an orange-brown Urfirnis slip: AΔK 108 and $\Delta 1323$ (Figure 6.17b, and Papathanassopoulos 2011, 200). The latter also carries some painted lines on the shoulder; it was found in the interior of Niche 31.

The Urfirnis vessels from this context can broadly be dated to early, middle and late MN phases, according to Phelps' chronology (2004, 44, 52). According to the Franchthi criteria, the applied pellet on the patterned Urfirnis and the decorative motifs tend to belong to FCP 2.3 (*i.e.*, middle MN) or earlier (Vitelli 1993, fig. 38, and figs 50–51). The monochrome Urfirnis vessels have sharp carinated profiles, so they could be dated to a late MN phase, a time

which witnesses a decline in the painted decoration (Phelps 2004, 44–45; see also Vitelli 1993, 486, fig. 85a) or FCP 2.3 according to the Franchthi chronology (*i.e.*, in the middle MN period, see Vitelli 2007, 8, table 1.3.).

Black-on-Red ware

This is a ware considered to have developed out of the MN Urfirnis. It thus combines MN Urfirnis fabric with new LN matt-painted ware forms and decorative motifs, in manganese paint (see discussion in Phelps 2004, 67–70; Dousougli 1998, 89–90). In Chamber Z part of only one closed vessel that could be attributed to this ware has been identified ($\Delta 14907$, CPII 12, and Papathanassopoulos 1996, 219, fig. 23; 2011, 203, fig. 150). It is coated with a thin red slip (5YR yellowish-red), well burnished; it bears a painted decoration in black and red paint (2.5YR 4/8 dark red), the motifs surrounded by thin black lines (5YR 3/3 dark reddish-brown).

Black Burnished ware

Found distributed throughout Neolithic Greece, from the Peloponnese to Thrace, the presence of this ware has accordingly been called a *koine* of Late Neolithic (Demoule and Perlès 1993, 392); the vases share similar shapes and types of decoration, such as pattern burnishing, ribs and beading, added plastics, incision, thick white paint, and grooves (Phelps 2004, 70–76; Dousougli 1998, 60–88).

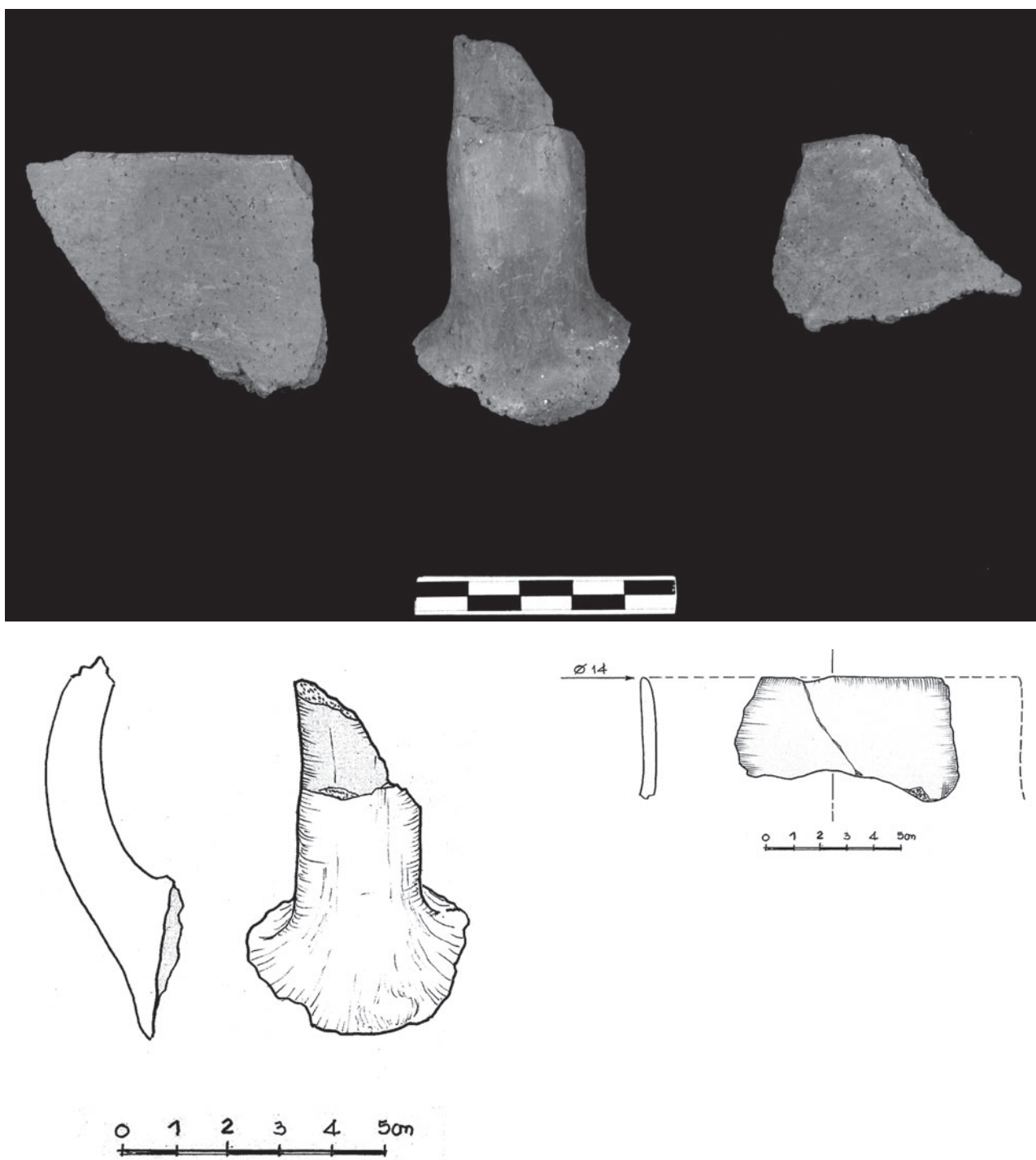


Figure 6.8. Earlier Neolithic material (late EN/MN) from Niche 31 (photo by Andreas Heliakopoulos).

In Chamber Z a few vessels of this category have been found. As their conservation is not complete, we cannot provide specific numbers and drawings. Their surface is dark grey to black, burnished to a high lustre. The commonest shape is the collar jar (see similar shapes in Phelps 2004, fig. 28.4), but some open vessels exist too (Figure 6.18), such as a few shoulder and carinated bowls (e.g., Δ17687, Papathanassopoulos 2011, 188,

fig. 135 and similar examples in Phelps 2004, fig. 27.16), collar bowls (similar to Phelps 2004, fig. 29.9, 10), and two pieces of the rim of fruitstands (similar to Phelps 2004, fig. 25.25, 27). Some of the bowls bear painted decoration in white matt paint (e.g., Δ17687, found on the bedrock of Niche 22a), as well as ripple decoration on the shoulder, pattern burnishing or plastic decoration (relief bands).

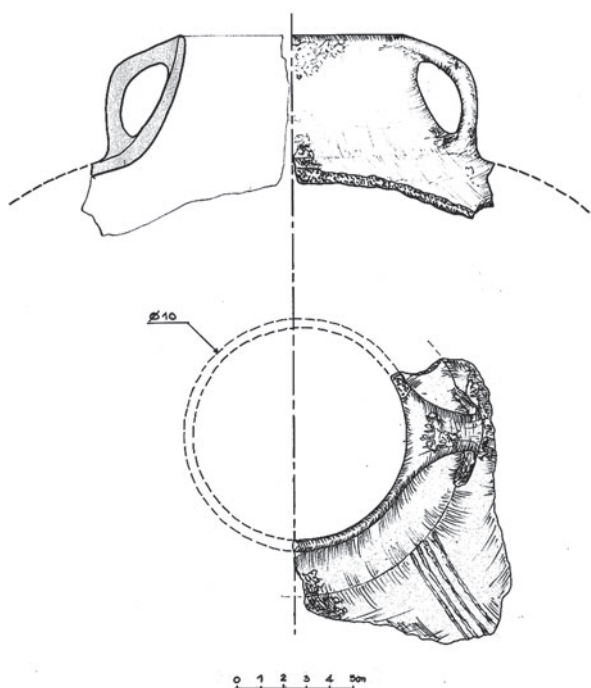


Figure 6.9. Late Neolithic collar jar in Matt Painted ware from Niche 31.

Grey Burnished ware

Also characteristic of the beginning of the LN period (for southern Greece, see Phelps 2004, 77–85; Dousougli 1998, 60–88; for a recent review of literature and the implications of the Grey Burnished ware in Neolithic Greece, see Bonga 2013, 179–194). The main shapes used for Grey Burnished pottery in the Peloponnese are similar to those used for the Black Burnished; they include fruitstands, simple open bowls, shouldered and carinated bowls, collared bowls, concave cups, piriform and collared jars (Phelps 2004, 77–81).

In Chamber Z the amount of this ware, as also of the Black Burnished, is minimal. That was also the case in the Cave of Euripides (Mari 2001, 82) and at Franchthi, where Grey Burnished Ware was never present in large quantities (Vitelli 1999, 43, 52). In Chamber Z we have encountered only one open vessel, a shoulder bowl (Figure 6.19a) bearing painted decoration on the shoulder of thin parallel and diagonal lines (similar shapes are seen in Phelps 2004, fig. 31.20 and 24), a small number of collar bowls (similar to Phelps 2004, fig. 33.8, 12, 14), and two pedestals from fruitstands. Closed shapes (Figure 6.19b) comprise a piriform jar (*cf.* Phelps 2004, figs 33.9 and 90.1) and collar jars (Phelps 2004, fig. 33.18, 19, 20). Their surface is grey or pale/silvery grey or sometimes green/brown, and always highly burnished.

Matt Painted ware

Along with the Black Burnished ware, the presence of Matt Painted ware is considered to indicate a *koine* of Neolithic Greece in the beginning of the LN (Weinberg

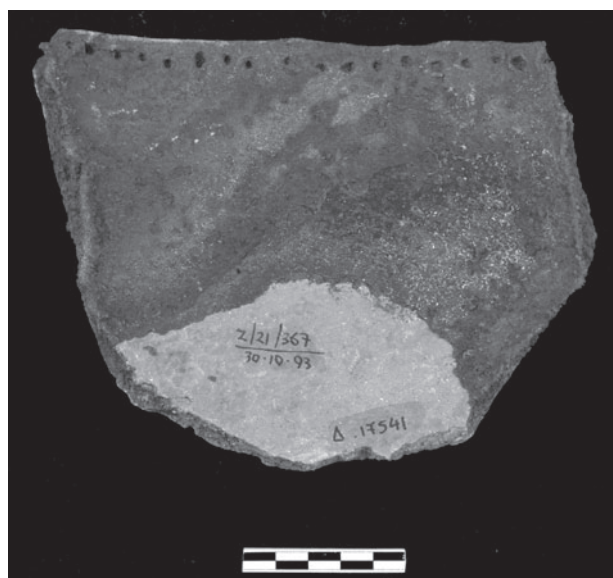


Figure 6.10. FN red monochrome pottery covered with stalagmitic material, from Niche 22 (by Andreas Heliakopoulos).

1962, 197–198; Phelps 2004, 87–96; Dousougli 1998, 93–96). It apparently has a long lifespan since it is found down into the middle 5th millennium BC or later (*e.g.*, at the Tharrounia cave, Sampson 1993, 286; see also discussion below, in fnt 11). The characteristic of this ware is the painted decoration ('manganese pattern painted', see Vitelli 1999, 4) in dark brown/black or red dull paint on a light ground/surface (red, light brown, cream and grey).

In Alepotrypa and especially in Chamber Z, hundreds of vessels of this category was found. Most of these vessels have already been conserved, so we are able to recognise shapes and decorative motifs (Figure 6.20; CPII 8, and many examples in Papathanassopoulos 2011). However, sherds or parts of vessels of the Matt Painted variety are also noted (*pers. exam.*) in other parts of the cave (*e.g.*, Θ 11, Θ 25, Θ 27, and in Trench B1). They occur, however, in lower quantities, in different shapes, and are not so well preserved as in Chamber Z.

According to the excavation records over 400 vessels of this ware were found in this area. Only four of them are open shapes, *i.e.*, bowls. The rest of them are closed vessels, either collar jars or piriform jars (see similar shapes in Phelps 2004, figs 41, 42). The shape of the fruitstand – a very common shape in this ware in many LN sites and caves – is completely absent from Chamber Z. Even in the rest of the cave the fruitstand occurs in low quantities.

The open vessels include one open bowl with convex walls and a slightly outturning rim (Papathanassopoulos 2011, 187, fig. 134), two open bowls with two vertical lugs on each side of the vessel (Papathanassopoulos 2011, 190), and a concave bowl with a strap handle on the shoulder (Papathanassopoulos 1996, 221, fig. 25; similar to Phelps 2004, fig. 40.10).

The closed vessels include mostly jars with convex walls and low or high vertical collars (see also Papathanassopoulos 2011, 192–199, figs 139–146; Papathanassopoulos 1996, 219, fig. 22 and 221, fig. 26). Most common though are the high conical collars (Figure 6.20). Strap handles rising from the rim or from the collar to the shoulder are found on many vessels, but some bear no handle at all. The bases of these vessels – whenever preserved – are always flat. The diameter of the collars is up to 0.13 m, while the diameter of the open bowls up to 0.23 m. The height of the jars ranges from 0.18–0.20 m up to 0.37 m.

The slip on the surface is light brown or yellow (7.5YR 7/6 reddish–yellow, 10YR 7/4 very pale brown, 6/4 light yellowish–brown, 5/4 yellowish–brown, 7/6 yellow), in a few cases red (5YR 5/6 yellowish–red), brown (7.5YR 6/4 light brown), or grey (2.5Y 7/2 light grey, 4/3 light brown, 10 YR 4/3 brown). In some cases, and particularly on the matt-painted collar jars found in Niche 31, a thicker creamy/yellowish slip (10YR very pale brown, 2.5Y 8/4 pale yellow) was added over the red clay (CPII 8). The vessels with this kind of slip are made with a different fabric (Fabric Group 4, see Pentedeka this volume). Phelps (2004, 100) also distinguished between a (LN Ib) polychrome decoration on a white slip (at Nea Makri and the Cave of Pan at Oinoe) and one without the white slip (Athens Acropolis).

The *paint* is either dark brown and black (7.5YR 3/2 dark brown on the reddish–yellow surface, 2.5Y 3/2 very dark greyish–brown on the grey surface, 5YR 3/1 very dark grey, 2.5/1 black on the brown and yellow surface) or red (5YR 4/6 yellowish–red on a 7.5YR 6/6 reddish–yellow surface). It is always matt. In closed vessels the slip is mostly applied on the outer surface; on the inside it is restricted down to the base of the collar. Most of the vessels are well burnished or smoothed outside and with no further treatment inside, but there are also cases with coarser surfaces. The vessels with the red clay/surface are usually unburnished. The thickness of the walls in the Matt Painted ware (as well as in the Polychrome one) ranges from 2 mm to 7 mm.

The *decoration* comprises every kind of motif usually found on this kind of vessel: triangular motifs, vertical lines and stripes, geometrical motifs, and so on (see some in Phelps 2004, 217). However, they are applied in very different ways. Each vessel has a pattern of decoration unique to itself.

Polychrome ware

This is produced by using a combination of both manganese and iron-based pigments. It belongs to the same category as the Matt Painted ware, but a second, red paint is added. In central and southern Greece it shares many shapes (fruitstands, carinated bowls, rounded shoulder bowls, jars), motifs, and compositions with the Matt Painted ware.

Many scholars tend to discriminate between ‘Polychrome Matt Painted’ – where red and black motifs are used independently of one another – which is known also as ‘Klenia style’ (from the Klenia Cave, Peloponnese; see Phelps 2004, 96; Dousougli 1998, 111), and ‘Gonia style’ polychrome – with black matt paint bordering red bands – that is attributed to a later stage in LN (Weinberg 1962; Dousougli 1998; Mari 2001; Phelps 2004, 100), and named after the excavation of Carl Blegen at Gonia, where this kind of pottery was first found (Blegen 1930–1931).

No matter what one may choose to call it, it is at basis a polychrome decoration. We should keep in mind that Polychrome pottery is characterised by such a stylistic variability at every site that it makes it difficult to find close comparanda for the decoration. The examples from Franchthi Cave (Vitelli 1999, fig. 55.8–9) were difficult to find parallels in either the Klenia or Gonia styles. Vitelli (1999, 20) had difficulty locating exact matches, as was also the case at Lerna (Vitelli 2007, 112, 115 and fnt 5), as well as in the Cave of Euripides for some vessels (Mari 2001, 103; see also Psimogiannou 2008, 171 and n. 148 for the Polychrome ware from Proskynas Lokris, and Mavridis 2008, 120 for the Cave of the Cyclops).

In Chamber Z there are 57 vessels of this ware. As in the Matt Painted ware, only four belong to open shapes, notably bowls (CPII 14) (also Papathanassopoulos 2011, 204, fig. 151). The rest belong to closed vessels and specifically collar jars. The bowls are of convex and shouldered types. One (CPII 14, and Papathanassopoulos 2011, 205, fig. 152) bears double vertical-pierced lugs on each side of the body (just as with the Matt Painted ware). The collar jars (see Papathanassopoulos 2011, 208–209) have a hemispherical body and high conical collars (one or two are cylindrical). Some bear a strap handle from the collar to the shoulder or to the body of the vessel. The closed vessels are slipped and burnished outside; the colour of the surface ranges from pale brown or yellowish to red–brown or pinkish (5YR 7/6 reddish–yellow, 10YR 8/4 very pale brown, 8/6 yellow, 7.5YR 7/6 reddish–yellow, 5YR 8/4 pink, 7.5YR 8/4 pink, paint: 7.5YR

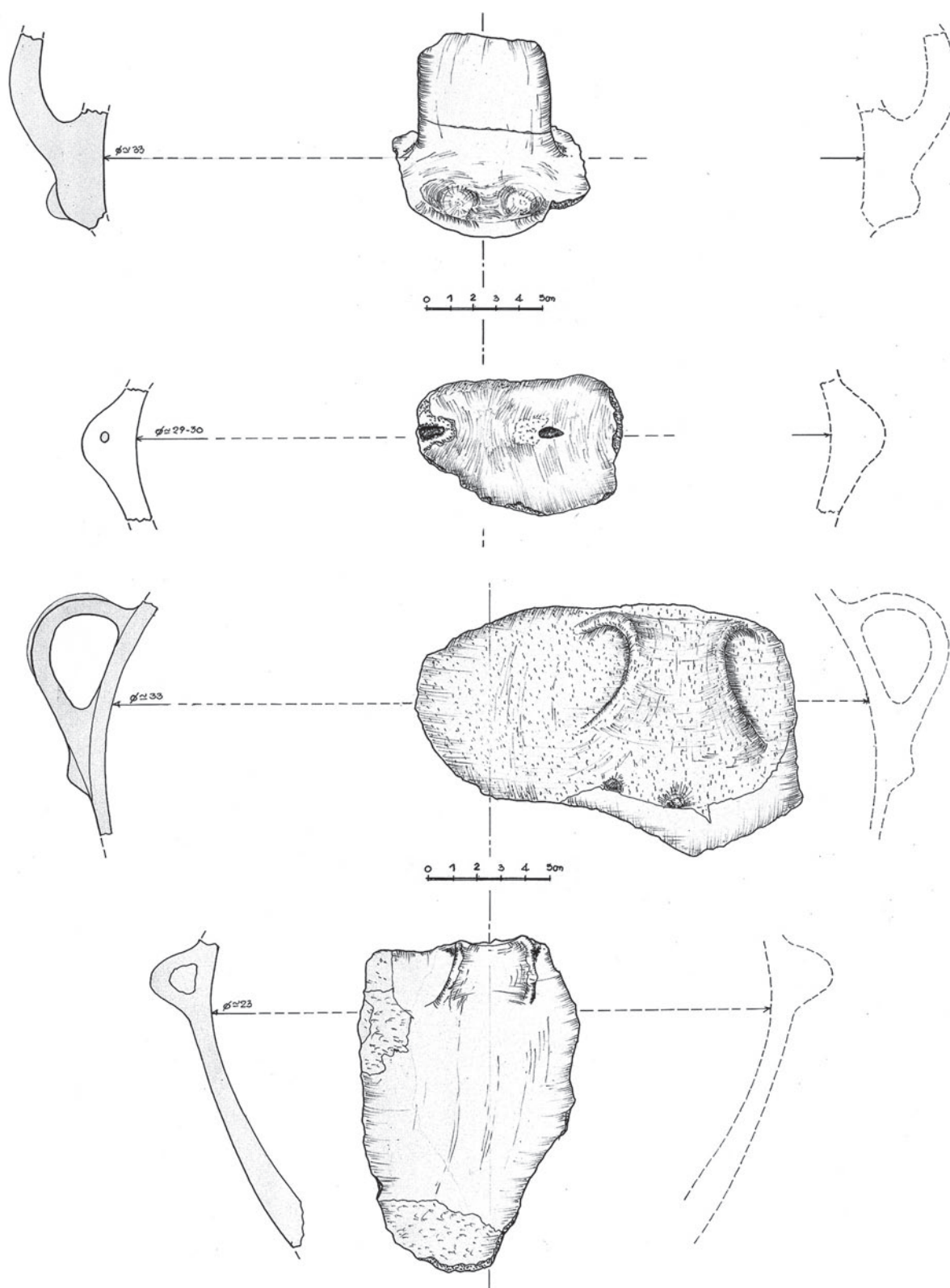


Figure 6.11. FN tubular lugs on jars from Niche 22.

3/2, 3/3 dark brown, 10R 4/2 very dark greyish-brown, 10R 5/8 red, 2.5YR 5/8 red). The bowls are slipped and mostly well burnished inside and outside. The diameter of the collars in the closed vessels is up to 0.20 m, while

in the bowls is up to 0.14 m. The height of the closed vessels ranges from 0.20 m to 0.30 m.

The decoration is characterised by variability on both open and closed shapes. Several motifs (lines, triangles,

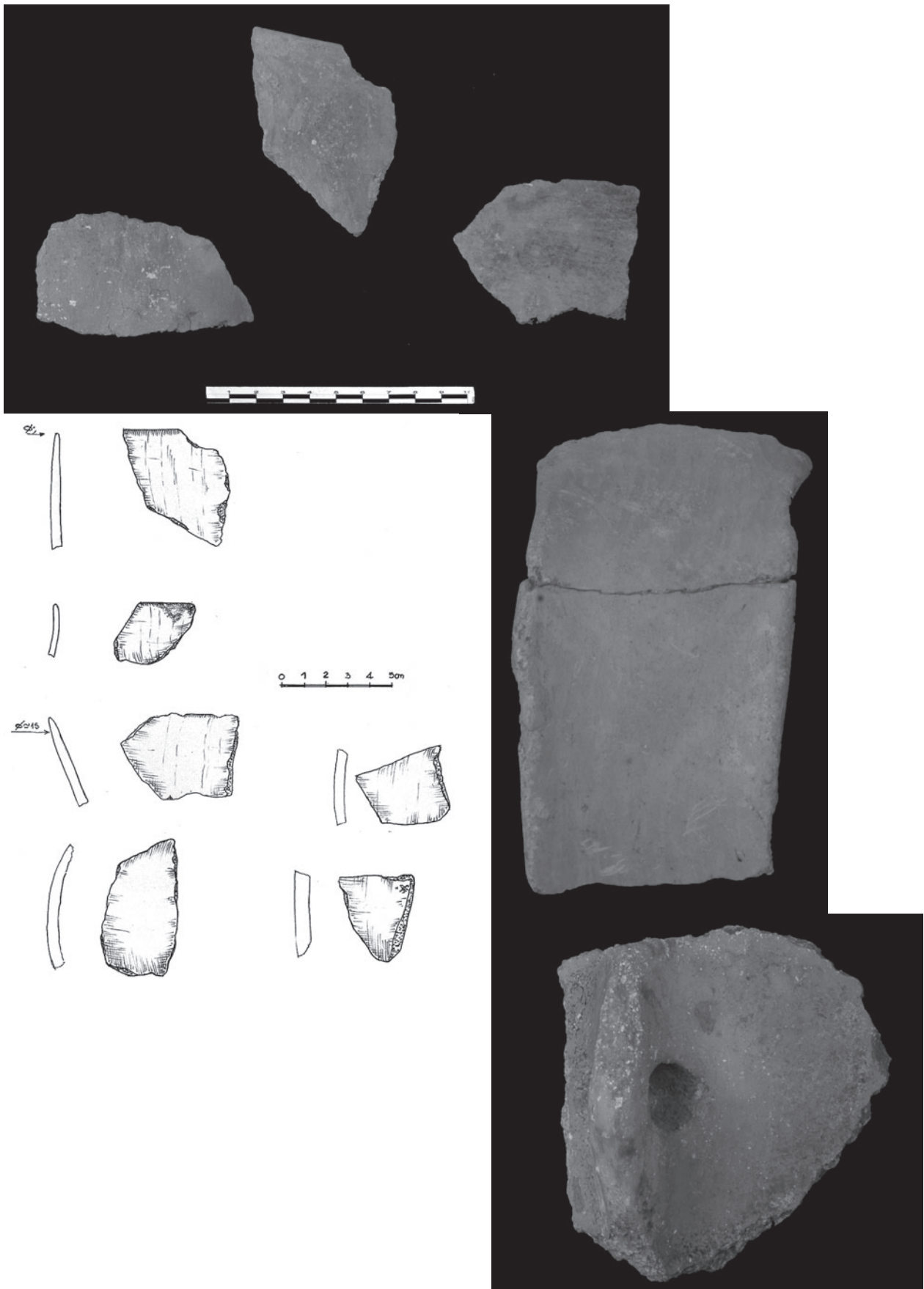


Figure 6.12. EN-MN pottery from Niche 22 (photos by Andreas Heliakopoulos).

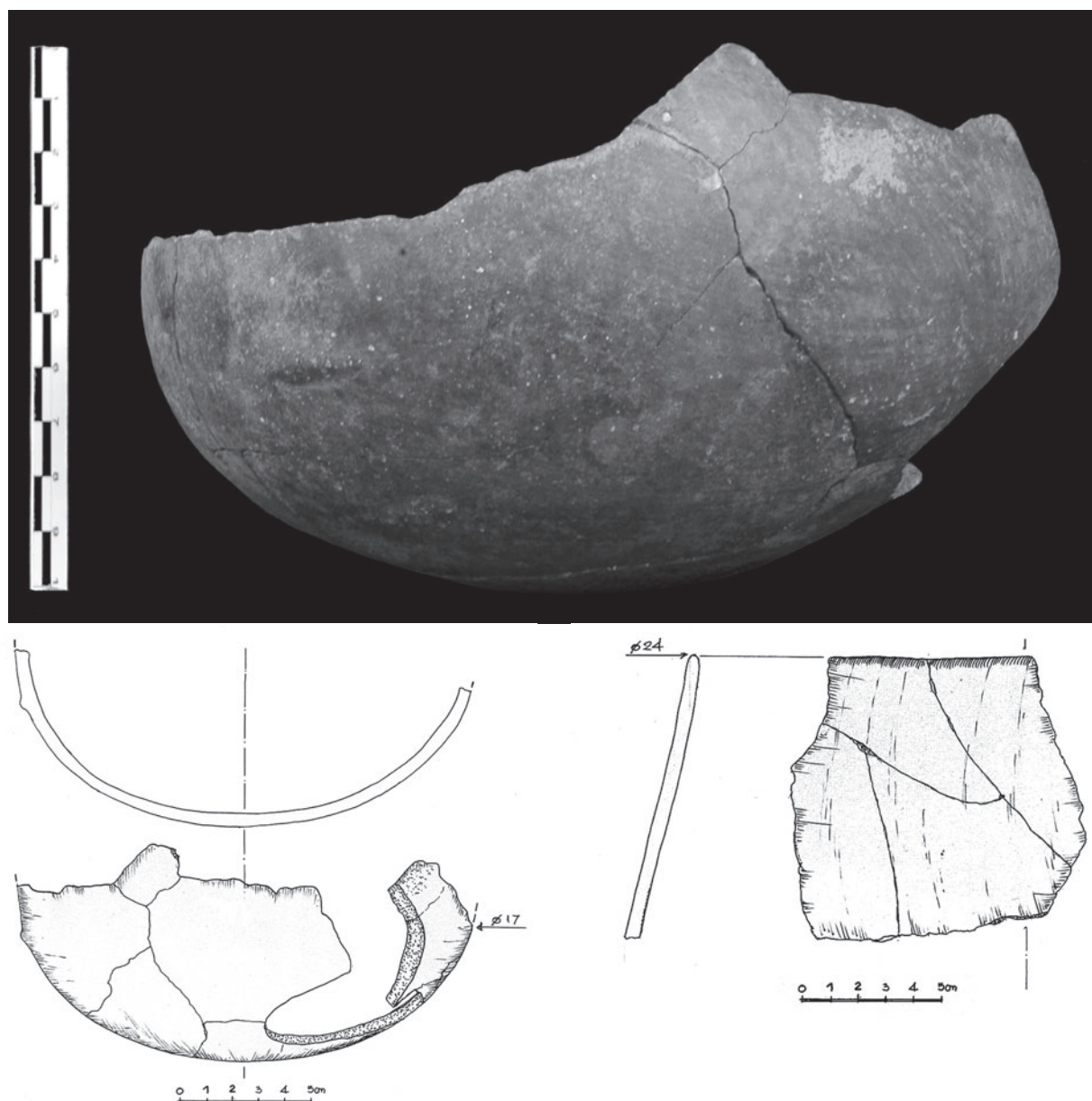


Figure 6.13. EN pottery from Chamber Z (photo by Andreas Heliakopoulos).

circles) in black and red paint are applied in most cases on the body, but their positioning and patterning are completely different on each vessel. Sometimes small black triangles hang from the lip on the interior of the collar jars ('Klenia style', according to Phelps).

For the manufacture of collar jars in both Matt Painted and Polychrome wares, the Fabric Group 6 has been used (calcareous and with clay pellets). Its composition is not strongly indicative of its origin, but local production is not excluded either (see Pentedeka, this volume).

Coarse and/or medium-coarse Red Slipped ware

Vessels belonging to a coarse or medium-coarse Red Slipped ware have been found in large quantities in Chamber Z, notably in the upper layers of the niches

as well as outside them (Θ 20, Θ 24). Because of their position many bear stalagmitic matter over their whole surface. This kind of pottery can be attributed partly to the Late and mostly to the Final Neolithic,⁵ judging by the circumstances of its presence in other sites and cave assemblages (Phelps 2004, 112–120), as well as in corresponding strata in Trench B1 of Alepotrypa itself.

This ware comprises mostly red/brown monochrome vessels with thick walls (>1.5 cm), with inclusions (small stones up to 3 mm) observable in the core/clay. In most cases there is a red/brown slip inside and outside (2.5YR 4/6 dark red out/in, 2.5YR 3/5 dusky red, 7.5YR 5/4 brown, 5/6 strong brown, 5YR 4/6 yellowish, grey core, 10YR 4/1 dark grey), in some cases without the application of a high burnish. In many cases, such as

the collar jars with tubular lugs, grey traces on the outer surface are visible or grey cores due to the firing (CPII 7), a property found in many FN assemblages in southern Greece (Vitelli 1995; Phelps 2004). The varied surface colour on these kinds of vessels at Alepotrypa and the dark core clearly show a somewhat limited control over the firing atmosphere (Pentedeke, this volume).

Pottery in this ware includes mostly closed vessels and a few open ones. The commonest shape is the biconical or globular collar jar with tubular lugs on the body (see Figure 6.5a–d; CPII 6 and 7). These vessels are medium to large in size (with a height up to 30 cm or 40 cm). The surface is covered by a red or reddish-brown slip, with no further treatment, except light smoothing. Only in some cases was a high burnish noticed. Most of the vessels belonging to this ware are made exclusively from Fabric Group 2 (clay pellets and grog fabric), Group 3 (calcite) and Group 7 (calcite and grog fabric) (Pentedeke, this volume). Grog-tempering was a widespread tradition during the LN and FN in the southern Aegean (Papadatos *et al.* in press).

It is worth noting here that biconical jars similar to those found in Chamber Z have been recovered from other mortuary contexts of the FN period, such as at the cemetery of Kephala, Kea, and in Attica, at the Tsepi cemetery and on the North Slope of the Acropolis (also pers. exam.). At Tsepi they were deposited along with other deep open bowls and basins and found broken inside a large pit excavated among the cist graves. The use of this pit (the so-called ‘apothetis’) is attributed to the later FN period (Pantelidou-Gofas 2007). The same holds true for the jars that had been deposited in the so-called ‘wells’ of the Acropolis North Slope (French 1972, 17–18; Immerwahr 1971, 5–6, 20–21, pl. 1; Alram-Stern 1996, 159–160; Maran 1998, 75; Johnson 1999; Phelps 2004, 104; Zachos and Dousougli in press; Coleman 2011). Some of the biconical jars from the North Slope were found nearly complete, in some cases along with human skeletal material (*e.g.*, skulls) and animal bones (Immerwahr 1971, 2). Comparable jars have been found in the West Slope of the Athenian Acropolis too, again deposited inside a deep pit, called a ‘well’ (Platon 1968), and attributed to a late FN stage (see discussion in Coleman 2011; Zachos and Dousougli, in press). Lately, a jar with tubular lugs and high conical neck, analogous to those from Alepotrypa and the other sites, has been found during a rescue excavation at the site of Schoinos in the Corinthia (Andreadaki-Vlazaki 2012, LZ’ EPKA, 115, fig. 15). It contained a human cremation and was covered with a smaller open vessel. The item however has been attributed to the Early Helladic period. In Chamber Z, where these collar jars have been found, the later FN date from radiocarbon dating on human bones is 3891 ± 62 cal BC (Ox-A 29204; 5104 ± 32 BP).

The open shapes include a few hole-mouthed pithoid vessels, some ‘cheese-pots’ (Figure 6.21) or baking pans,

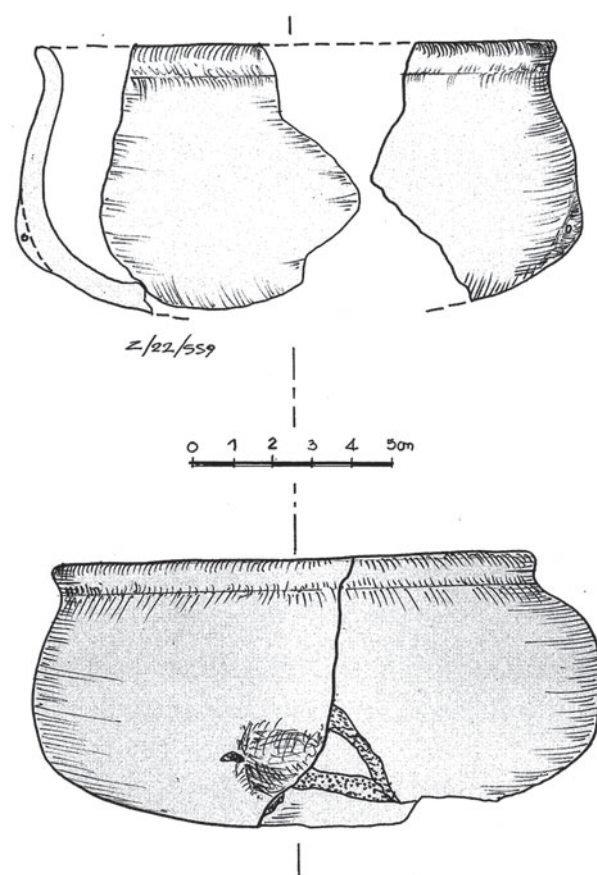


Figure 6.14. Pottery with red crusted decoration from Θ 24.

as well as a few bowls, deep and shallow, in both coarse and medium-coarse ware (Figure 6.22). They cover all ranges of conical, convex and concave profiles. A complete narrow and low solid foot (Figure 6.6b) (similar to others at Kephala, Kea, and in the Athenian Agora; see Phelps 2004, 229, fig. 55.18) comes from a bowl/fruitstand. Surfaces are slipped (red or red/brown surface: 7.5YR 5/6 strong brown, 7.5YR 4/3 brown, 2.YR 4/6 dark red), usually more polished than on the collar jars and in a few cases well-burnished. Or they may have rough surfaces and a coarse fabric, and be unevenly fired to grey and whitish shades. These characteristics are seen on the bowls found in Niche 31 (Figure 6.7), which show high variability in their surface treatment and profiles. Most present affinities with bowls found at other FN sites (*e.g.*, Dousougli and Zachos 2002, fig. 7 from Doliana; Zachos and Dousougli in press, fig. 6). Some other red slipped bowls that were found in Θ 24 bear incised decoration of parallel lines and dots under the rim (Figure 6.22a, b; see similar decoration at Kephala Kea, Coleman 1977, pl. 32).

Surface material from Θ 24: ‘crusted’ and ‘fluted’ bowls

For the purposes of this paper we will briefly refer to some characteristic vessels that were collected in a very good stage of preservation (during the 2000 season) from the

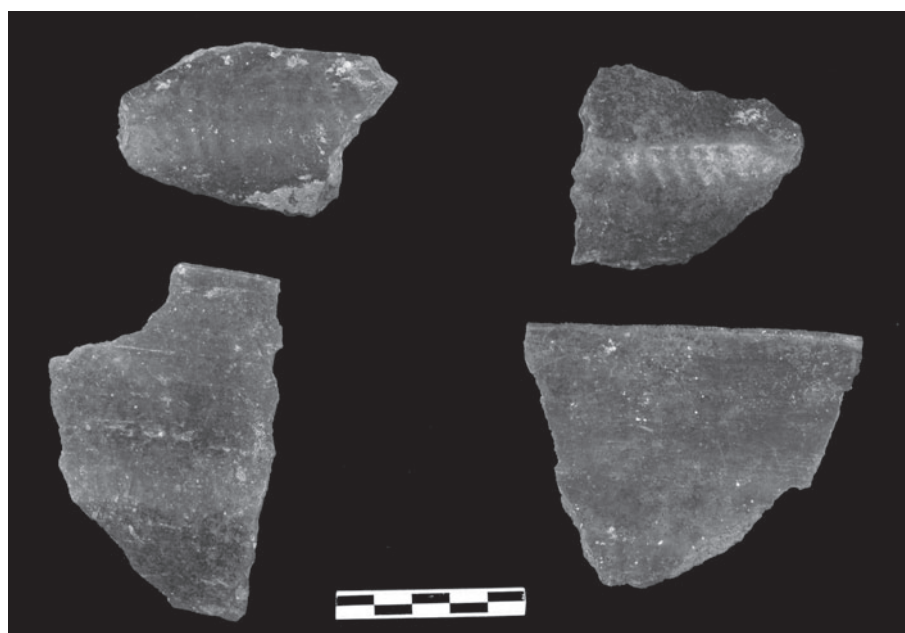


Figure 6.15. FN 'fluted bowls' from Θ 24 (by Andreas Heliakopoulos).

upper surface of Θ 24, opposite the three niches. They are of sufficient importance to be included in this first presentation of the pottery material from Chamber Z.

Parts of two vessels of crusted ware have been found to date in Chamber Z (Figure 6.14; CPII 10). Crusted ware is widely distributed during the Greek FN (Phelps 2004, 108–111). It is characterised by a thick paste (red or white) applied to the vessel after firing. The first pot is half of a bowl, dark slipped and burnished, with a small, horizontal tubular (unperforated) lug. It bears a crusted decoration of red paint running beneath the rim, while traces of more are discernible under the belly and near the lug. The rest of the paint has flaked off. It was found on the upper surface of Θ 24, opposite Niche 22. The second vessel is part of a miniature vessel, a biconical jar with out-turning rim. Traces of red pigment⁶ can be distinguished on the interior.

The chronological implications of crusted ware have been discussed thoroughly. It characterises the FN until its end (Broodbank 2000, 154). Crusted vessels in the Peloponnese are found in several mortuary contexts: at Aria in the Argolid (Dousougli 1998, 132–133) and in the two FN burials from Lerna (Caskey 1958, 136 and pl. 37a, c; 1959, 205, pl. 41b; Vitelli 2007, 121–122). At Franchthi Cave crusted ware was also found at the upper levels (Phelps 2004, 111), while a vessel with red crusted decoration was found inside one of the five FN pit-burials that were investigated on the Paralia (Vitelli 1999, 87, fig. 67i). They are also typical of the Kephala cemetery (Coleman 1977, 10–11), as well as the Tsepi cemetery in Attica (Pantelidou-Gofas 1998, similar shapes also are to be seen on display at the Marathon Museum), which began in the late FN and continued on into the

beginning of the EBA (Pantelidou-Gofas 2007; 2008). In the Cyclades, crusted vessels are also found in FN caves (*e.g.*, Zas, Strata I-II, Antiparos cave; for further discussion see Zachos 1987, 14–15; 1999, 153–154; Broodbank 2000, 154; Mavridis 2010, 23; Zachos and Dousougli, *in press*) and in mortuary contexts of the end of the FN/early EBA, that is, Grotta-Pelos cemetery assemblages (Renfrew 1972).

Another distinctive vessel type in this context is the so-called 'fluted bowl', which bears a kind of ripple decoration on its belly (Figure 6.15). They turn up in many sites both in central Greece (see Caskey and Caskey 1960, 140 and Pottery Group III.10, fig. 4, pl. 47, from Eutresis in Boeotia; Immerwahr 1971, pl. 6, from the Acropolis North Slope wells) and the Peloponnese. They are always a dark slipped and burnished ware and are considered of a later FN date, both in Greece and the wider Balkan region (see discussion in Johnson 1999, 325–328, fig. 4). In Alepotrypa Cave, 'fluted' bowls appear in other locations as well (*pers. exam.*).

Patterns of pottery consumption

Chamber Z has yielded a large quantity of pottery spanning the Neolithic (late EN, MN?, late MN-early LN, LN, FN), according both to relative and absolute chronologies: this is in accord with similar pottery evidenced in the stratigraphical sequence of Trench B1.

In terms of shapes, it is obvious that in almost every period there is an overwhelming preponderance of closed shapes, notably collar jars (a fact that had been also noticed by Phelps in his first examination of the pottery, 2004, 13) either narrow or wide-mouthed. It



Figure 6.16. MN Collar jars in lime ware (by Andreas Heliakopoulos).

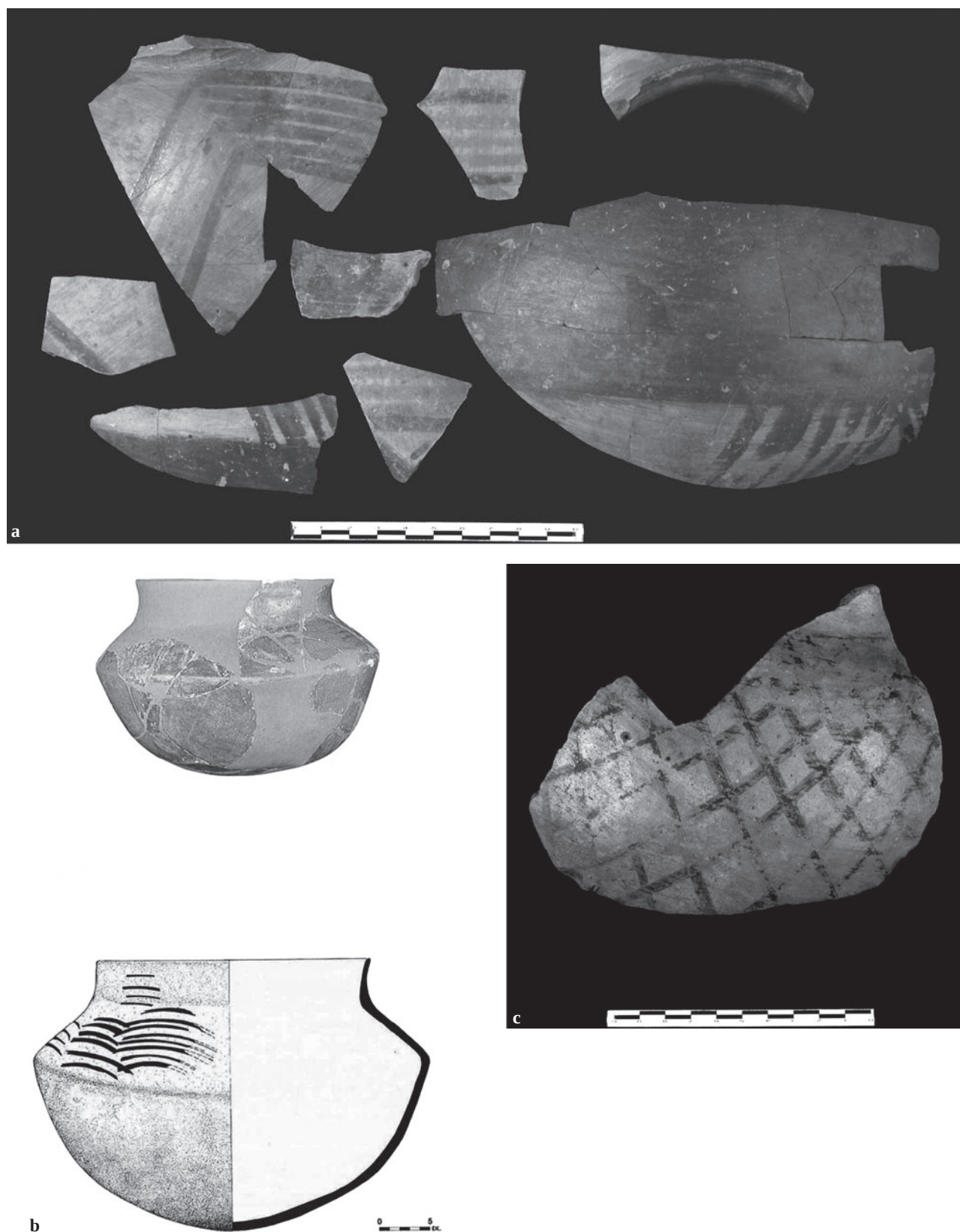


Figure 6.17. MN Urfirnis vessels found in Chamber Z. a) and c) Pattern-painted Urfirnis jars (photos a and c by Andreas Heliakopoulos); b) Urfirnis collar jar bearing an orange-brown slip from the interior of Niche 31 (after Papathanassopoulos 2011, 200, catalogue number 147).

seems that in almost every prehistoric period the people of Alepotrypa chose this particular type of vessel to use in this particular part of the cave. The presence of open shapes, that is bowls, which are abundant in other cave pottery assemblages (*e.g.*, Sarakenos, Sampson 2008; the Cave of Euripides, Mari 2001; Franchthi, Vitelli 1993; 1999) is restricted to just a few pieces (four in the Matt Painted and Polychrome ware, one in the Grey Burnished, some in the Red Slipped and Burnished ware, a few ‘fluted’ ones). Some other shapes, such as the fruitstand, which is usually attested in similar contexts (*e.g.*, Franchthi, Sarakenos, Tharrounia, the Cave of Euripides), are completely absent from Chamber Z in the Matt Painted and Polychrome categories, as well as in the Urfirnis. In the coarse and medium-coarse Red Slipped ware the collar jar with tubular lugs on the body seems to be the predominant form. For example, in Niche 31 it was represented by almost 40 examples, while only seven low bowls were found.

In terms of fabrics, the main recipe for pottery making is represented by Fabric Group 1, which remained in use throughout the Neolithic period and includes vessels of all wares, shapes and sizes, be it a pithos or an Urfirnis jar. Nevertheless, most of the other recipes identified appear to be rather period- and ware- or shape-specific. Similar observations have been made by Stroulia (this volume) apropos specific rock types being chosen for specific types of ground stone tools. Moreover, the majority of the fabric compositions seem to be broadly compatible with local sources, so the pots appear for the most part to have been made locally (see similar discussion in Vitelli 1999, 98).

On the other hand, some small quantities of imports are attested in Alepotrypa by the present data – in the Black and Grey Burnished wares (Fabric Group 5, see Pentedeka this volume). Vitelli (1999, 43) had also determined that the Grey Burnished ware found at Franchthi was intentionally produced, using a particular fabric (her ‘Grey Burnished variety’) not found in other wares, suggesting that these examples were imported. In addition, there always remains the possibility that pottery from Alepotrypa with close parallels to assemblages from other caves (*e.g.*, Figure 6.23, where a low collar jar bearing a square handle is similar to material in the Antiparos cave, Mavridis 2010, 24, fig. 7.64) and vessels not compatible with the Peloponnesian repertoire (*e.g.*, a strap handle, Figure 6.12c, similar to one from MN Otzaki Magoula, in Papathanassopoulos 1996, 257, fig. 106) could have been imported either from the southern Aegean or from Thessaly and northern Greece. Future petrographic and ceramic analysis will elucidate these issues.

Furthermore, we should stress that, although there seem to be strong pottery traditions in terms of pottery manufacture and pottery shapes, as evidenced by the persistent use of specific shapes and fabrics for specific wares and periods, there is an amazing stylistic

differentiation in the pottery of Chamber Z. This differentiation is accomplished in other ways, such as the decorative patterns and their distribution on the painted pottery, the lugs and rims in the monochrome pottery, or their different surface treatments. Even though there are repeated shapes, the vessels all show high variability.

To provide some examples: the motifs of the painted MN and LN pottery (*e.g.*, triangles, lines) may indeed be shared over a broad geographical area in central and southern Greece and recognised as a distinctive style since they are found so very often on Neolithic vessels, thereby indicating a level of social contact (Cullen 1985; Halstead 1999; Cavanagh and Mee 2005, 28). However, in the assemblage of Chamber Z, these motifs are applied on each vessel in a completely different way, resulting in individualised pots. Similar observations have been made for the decorative style of patterned Urfirnis pottery at Franchthi Cave (Vitelli 1993, 196) and for the differentiation within Matt Painted and Polychrome ware in many other cases (Vitelli 1999, 97–98; 2007; Dousougli 1998, 108; Psimogiannou 2008; 2012; Mavridis 2008; Bonga 2013, 47).

Indeed the same can be said to hold true for FN pottery in general: despite its similarities in manufacture and appearance and the fact that it is found throughout a broad ceramic region with intense stylistic interactions (Vitelli 1999, 103; Broodbank 2000, 163), it is undeniably characterised by variability (Vitelli 1995, 58; Perlès and Vitelli 1999, 99; Cavanagh and Mee 2005, 31–32). In Chamber Z the consumption of all the above vessels is probably a deliberate choice and related to the specific context where these vessels were deposited and indeed perhaps made for, as will be discussed below. Probably these individualised vessels in every ware carried a specific meaning or were created and designed for a specific occasion, specific individual(s) and/or social

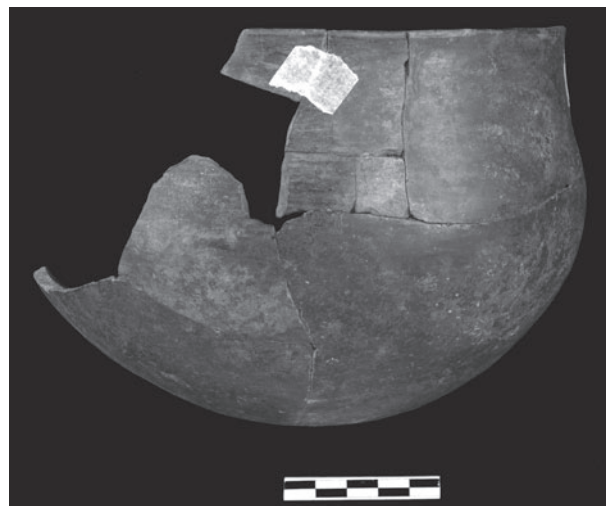


Figure 6.18. Black Burnished pottery (by Andreas Heliakopoulos).

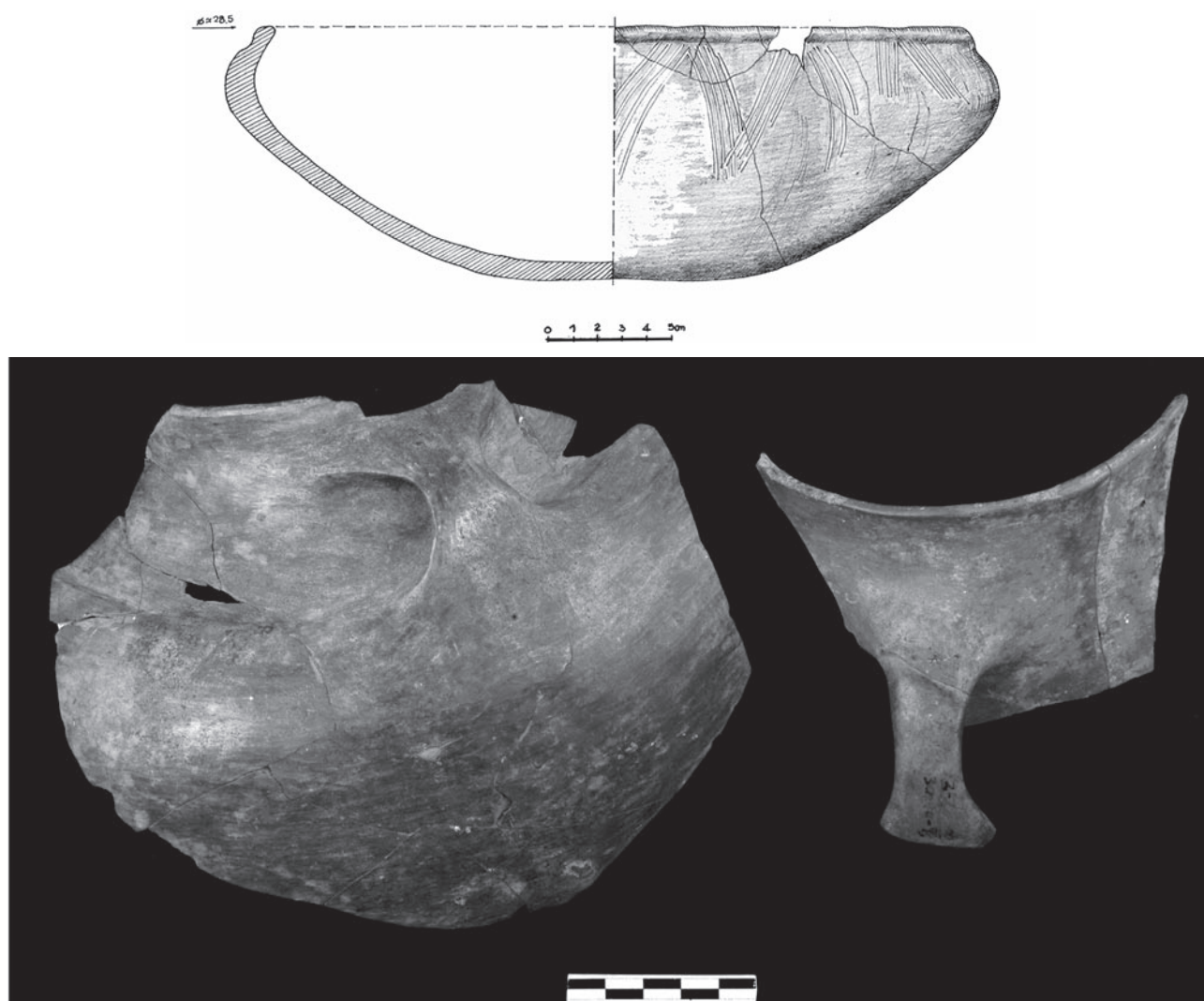


Figure 6.19. Grey Burnished pottery (photo by Andreas Heliakopoulos).

groups (see similar discussion in Vitelli 1993, 196, 216 about pottery at Franchthi Cave).

Patterns of pottery destruction and deposition

The preliminary examination of the pottery from Chamber Z has allowed us to draw some first conclusions concerning pottery depositional patterns. Because of the good state of preservation of the Neolithic deposits in the interior of the three niches and due to careful excavation procedures, we were able to recognise some patterns of distribution and deposition that probably represent the original picture of Chamber Z in the Neolithic period.

According to the evidence described in detail above, a very intriguing pattern of deposition is attested and repeated in all three. The niches of Chamber Z are characterised by an accumulation of sherds, creating a deposit up to 80 cm deep in places. The first thing to observe is that sherds attributable to earlier periods of

the Neolithic (*i.e.*, EN to LN) are found in the lower layers and close to the bedrock – many of them belong to painted wares. The upper material comprises mostly FN monochrome pots. The stratigraphy and relative positions and depths of the pottery in the interior of the three niches reveal that sherds and parts of vessels accumulated continuously one above the other, and were probably deposited there in a chronological order.

Another interesting point that emerged was that many sherds joined to produce reconstructable vessels – some almost complete, but only a few entirely so.⁷ But these joining sherds come from different spots in Chamber Z, being distributed over a wide area. Although the spatial distribution of the pottery is currently under study, first impressions indicate that at least one sherd from a reconstructed vessel comes from the inner part of a niche, while the rest were found either in the area outside or in the interior of another niche; despite the different horizontal findspots, the depth of their findspots matches, *i.e.*, near bedrock or higher up. This argues that the vase, already

broken, was distributed in several places in Chamber Z, presumably deliberately.

For example, the most part of the patterned Urfinis collar jar (CPII 11) was found at the entrance of Niche 22, but part of its body (CPII 13), comprising eight joining sherds, was found spread out and distributed in the interior of the nearby Niche 22a, lying on the bedrock. The same holds true for several vessels in the Matt Painted ware that were reconstructed: their sherds were found scattered inside Niches 22a and 22 (see these vessels in Papathanassopoulos 2011, 188–190, 196, 198, 206, where the provenience of each vessel is also mentioned). Part of the collar of a jar in Polychrome ware, the only vase in this ware from Niche 31 (CPII 9), was deposited in its interior. It joined with another part of the collar found metres away, opposite Niche 22. The nearly complete, and unique in this assemblage, shoulder bowl in the Grey Burnished ware (Figure 6.19a) was reconstructed from many pieces. The majority was found in Θ 24, with only one inside Niche 22 at the very back and another one inside Niche 22a. In the case of the EN bowl (Figure 6.13a, b), the majority of the sherds that joined come from Θ 24, but one sherd was found deposited in the interior of Niche 22. Many sherds remain without partners (*e.g.*, part of a bowl in the Matt Painted ware found in the deepest end of Niche 22, see Papathanassopoulos 2011, 187, fig. 134).

The way the pottery was distributed, however, does help explain better the depth of the stratum accumulated inside the niches. Although the combined area yielded a huge number of vessels, the deposits themselves were not very thick, since they contained only sherds and parts of vessels packed down tightly one with the other in a kind of ‘stratigraphical’ sequence (this is also obvious in photo of Niche 22 before excavation, see Fig. 6.2a), a fact that eliminates the possibility that the dispersal of pottery is the result of disturbances in later times. It would thus seem that in this part of the cave the pottery was being intentionally broken.⁸ This deliberate fragmentation was then followed by an equally intentional separation of the pieces, with the pieces placed in a specific niche and/or in a second niche and/or outside. Many locales so participated in structured deposition processes (Chapman 2000). We cannot exclude the possibility that the missing fragments could be yet located in the unexcavated portions of Chamber Z or indeed at another spot of the cave, perhaps even taken out of it altogether, to be used in a different way or in a different context (see Chapman 2008, 196–198).⁹

The practice of intentional destruction of material objects has been discussed by many scholars involved with Balkan and Aegean prehistory, both for the Neolithic and Bronze Age periods (see several chapters in Driessen 2013; for a detailed discussion and relative literature on the issue of fragmentation, see Stroulia and Chondrou 2013). Fragmentation is nowadays

considered a widespread phenomenon, associated with a variety of contexts; cases of varying types of material culture (pottery, ground tools, animal and human bones, *etc.*) have been mentioned at various sites (mortuary, domestic, ritual) and interpreted also in various ways. One such is the idea of *enchainment*; here objects are broken so that the resulting pieces may be distributed among different individuals or groups. In this way, people are linked by tangible, material, lasting bonds (Chapman 2000; Chapman and Gaydarska 2007).

The association of deliberately destroyed material with death is very common. Many archaeological examples of intentionally destroyed objects or of the intentional fragmentation of the human body come from graves/cemeteries and other probable ritual contexts that span many chronological periods (*e.g.*, Hamilakis 1998, 122; Broodbank 2000, 267–268; Renfrew 2007a, 405–428; Renfrew *et al.* 2012; Tomkins 2012, 70–71). In recent years, there has been extensive discussion on deliberately broken material culture, apropos several cases and contexts of the Greek Neolithic (Pappa *et al.* 2004; Tomkins 2007; Vitelli 2007; Psimogiannou 2008, 2012; Tzevelekidi 2013). Similar observations have been made at many caves and for several material classes: at Franchthi, for pottery, figurines, ground tools and human skeletons (Jacobsen and Cullen 1981; Vitelli 1993, 217–219 and n. 9; Talalay 1993; Cullen 1999; Stroulia 2003), and for figurines at the Sarakenos cave in Boeotia (Sampson and Mastrogiannopolou 2017; see further discussion in Tomkins 2009, 140–142; 2013).

Cases of intentional separation of parts of the human skeletons are recorded in Alepotrypa: in the case of the FN Ossuary II (Papathanasiou 2001, 2009, and Chapter 13 this volume; Katsarou, this volume) specific fragments (*e.g.*, skulls) had received special treatment; they were found deliberately positioned and delineated variously with stones and bones. In the case of the three niches in Chamber Z, intentional breakage of the pottery during funerary ceremonies has been stressed by Papathanassopoulos (1996c, 2011).

One particularly salient fact is that the people who participated in these fragmentation activities at Alepotrypa did so in a systematically repeated way over centuries, according to relative and absolute chronologies. The result is the considerable accumulation of sherds. Consequently, the three niches and Chamber Z represent a *continuum* of practices of fragmentation and structured deposition of material culture. The breakage looks so systematic that it must have been undertaken in the course of a series of deposition episodes. One of the questions that needs to be examined is whether the pottery had been used at all before its destruction and deposition. Was it transported to this spot after use elsewhere (see discussion in Renfrew 2007a, 419–420)? It may also be that one or more pieces of a vessel were deposited in one or more niches at a certain time, while other fragments were retained to be deposited

elsewhere in the cave or removed from it at some later time (see Stroulia and Chondrou 2013, 123, 127).

Moreover, in the future it remains to see whether the pottery fragmentation, deposition and distribution patterns may relate to those of the human bone scattered in secondary rites (Parker Pearson 2003, 50–52; see also Robb *et al.* 2015 for a similar situation in the Scaloria Cave, Italy), as well as such patterns for other kinds of material culture. As already discussed, this particular part of the cave has produced only secondary burials (Niche 31) and dispersed human bone. Radiocarbon dating on two human bones from the surface area of Chamber Z and from one of the child bones in Niche 31 produced dates of the FN period (4230–3960 cal BC to 3892 cal BC = c. 4,200–3,800 cal BC). Thus at some point in the FN (or even later?) secondary burials were being deposited there. It is important to know if other human bones provide any earlier dates, ones corresponding to the earlier pottery (EN, MN, LN) known from Chamber Z. The presence of human bone would indicate that this part of the cave had, from the start, not been used for deposition of primary burials, in contrast to the rest of the cave and notably in the Northern Sector and Trench B1, where – along with scatters of human bone – the deposition of primary burials both in the FN and in previous periods is also attested (Papathanassopoulos 1996c; Papathanasiou 2009, and chapter 13 this volume).

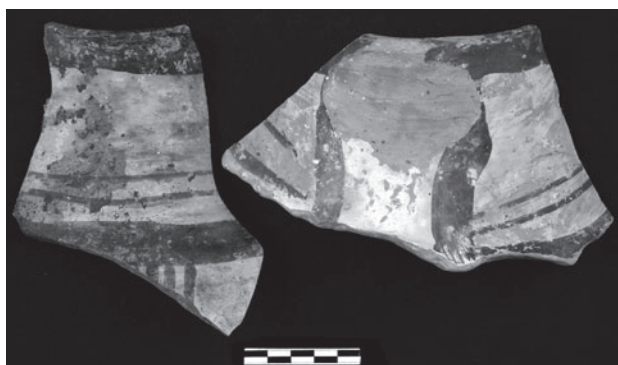


Figure 6.20. Matt Painted pottery (by Andreas Heliakopoulos).



Figure 6.21. 'Cheese-pot' (by Andreas Heliakopoulos).

Chamber Z, Alepotrypa Cave and the southern Greek Neolithic: chronological and social implications

The use of Chamber Z through time

Building on this presentation of the pottery and its deposition in the context of Chamber Z, we now expand our discussion to evaluate the use of the chamber in the wider context of the cave, and particularly in conjunction with the evidence from Trench B1 in the Northern Sector. The ceramic material and the stratigraphy of this trench have not been studied completely, so many of our observations must be considered preliminary.

Chamber Z and Trench B1 lie in two completely different areas of the cave: the latter is located near its entrance, and Chamber B is wider and more open, the other is much further in, just before the Chamber of the Lakes, and comprises niches off a small, close space. According to both the relative and absolute chronologies, the two areas seem to have been used at much the same time(s) during the Neolithic, but probably in quite different ways. Trench B1, as part of the Northern Sector, belongs to that part of the cave that allowed the accumulation of several cultural layers and saw the creation of a deep deposit resulting from the intense human presence and activities there over a long time (Karkanas, this volume). The first use of Trench B1 is estimated at the end of the EN, with the deposition of a burial. The first use of Chamber Z, too, goes back to the same period, according to pottery of an EN date deposited there and a radiocarbon date derived from the dung. Both probably carried on at least until the end of the FN: in Trench B1 down to c. 3,200 cal BC, although with a few breaks.

In more detail, both loci broadly have in common the same range of Neolithic pottery wares and pottery fabrics (Penttedeka, this volume). But their vases differ strongly in their shapes and state of preservation, probably indicating different circumstances of use and deposition. In Chamber Z a number of forms are absent: the pottery comprises mostly closed vessels. But an intense stylistic variability is evident. The same holds true for the few open vessels from there. On the contrary, in Trench B1 other shapes make their appearance, but the pottery is very worn, fragmented, and not at all well preserved (Katsipanou, this volume and pers. exam). The vessels from Chamber Z are in an excellent condition; probably this is because they were brought there to be at once disposed of during some particular activities. So treated, they remained 'buried' there, and were not subject to further wear and attrition.

Another important difference between the two areas concerns their mortuary practices. Trench B1 has yielded individual and primary burials of the late EN, late MN/early LN (?) and FN periods (Papathanasiou 2009, and Chapter 13 this volume), as well as much scattered human bone. This situation holds throughout the Northern Sector for the FN period. No burial of the early or middle phase of

the MN or of the rest of the LN has yet been found in the cave. Chamber Z, however, has produced only scattered human bone and secondary burials of the FN. It remains to be seen if the deposition of secondary burials was the main practice in Chamber Z earlier in the Neolithic too (*i.e.*, in EN and MN, see the discussion above).

In ceramic terms, in Chamber Z there is a massive quantity of vessels belonging to the LN and FN periods, when an intense use of the cave is generally attested, as is also seen in the stratigraphy of Trench B1 (Karkanas and Katsipanou, both this volume). This is not the case, according to the present evidence from Trench B1, for the EN and much of the MN periods (Karkanas, this volume). And it is probably not the case for Chamber Z either, albeit pottery of EN and MN date, corresponding to the little known in Trench B1, is present in some quantities. It cannot be determined at the moment if the cave remained in use during the whole of MN. The stratigraphy of Trench B1 (see discussion in Karkanas, this volume; Katsipanou, this volume) would rather imply that the cave during this period received only a few short visits, probably from a small number of people and only sporadically.¹⁰ The examination of the pottery found in the pure EN deposits of the cave (Ossuary I and the human burial in the lowest layer of Trench B1) will add significantly to our knowledge of the pottery choices and human practices in Alepotrypa at this initial phase.

For the LN period, the abundance, state of preservation and stylistic variability of vessels in Matt Painted and Polychrome wares are impressive, accompanied by a few pots in Grey and Black Burnished wares, as seen typically in Trench B1 (Katsipanou, this volume). The situation, though, is complex and confusing: with the exception of one human bone dated to *c.* 5,400 cal BC, which belongs to the collective burial found in Trench B1, and accepting that this date represents the beginning of a LN phase in the cave, not the last phase of a MN sequence (see papers of Papathanasiou, Karkanas and Katsipanou, all this volume), no other LN burial has been located in the whole cave (be it primary, secondary or but a scatter of bone). An absence of LN burials is noted also at Franchthi Cave (Jacobsen and Cullen 1981, 85, table 1, 96). Although the evidence from the Trench B1 stratigraphy for LN has not been studied in detail, a break during the early phases of the LN (*c.* 5,300–4,800 cal BC) seems likely, at least in this part of the cave (see Karkanas, this volume), though of course this does not necessarily imply a general one for the whole cave. This apparent gap notwithstanding, the ceramics do suggest a degree of cultural continuity (Katsipanou *pers. comm.*). The presence of typical LN pottery such as Matt Painted is considerable, both in Trench B1 and in Chamber Z. Whether this distinctive LN pottery represents the activities of people who continued visiting the cave on several occasions (as has been suggested in the case of Franchthi Cave for the same period, Vitelli 1999, 97), though not necessarily involving

any human burial deposition, is something that needs further examination.

Although it is beyond the scope of this paper, it is yet worth noting that although the LN ceramic wares of the Matt Painted and Polychrome, as well as the Black and Grey Burnished ones, that characterise the assemblage of Alepotrypa and especially Chamber Z, have received much attention in the literature, this is mostly from a typo-chronological perspective. A broader and contextual approach regarding their use during the LN in central and southern Greece is missing; this lack makes it difficult to discuss not only their use, but also their chronology. These wares are closely connected with LN people in the central and southern Greek mainland and characterise the particular period (see Vitelli 1999), although relatively few of these vessels have been found in purely domestic contexts. Often considered apart from their archaeological context, and given their great stylistic variability, the comprehension of LN ceramic chronology is made all the more difficult.¹¹

Emphasis has been placed mostly on the stylistic development of Polychrome ware (be it ‘Gonia’ or ‘Klenia’ ware), (*e.g.*, Weinberg 1962, 198; Bonga 2013, 107–121), although it is also characterised by great stylistic variability. The broader cultural and archaeological context of this ware has been left out of the discussion, resulting again in many repercussions concerning its chronology and use.¹² Chamber Z and the manner in which the pottery was deposited there cannot at the moment provide any new information to help clarify the chronological sequence of the Matt Painted and Polychrome wares. Examination of the stratigraphy of Trench B1 where these wares are also attested could be of more value regarding this issue (Katsipanou, this volume).

It is impressive that both the cave and the excavation at the nearby open-air site of Ksagounaki have produced several FN burials dated in the period between 4,100 BC and 3,800 cal BC (Papathanasiou *et al.* 2013; Parkinson *et al.* 2015). This implies an intense burial activity and burial visibility during this period at the site. The early stage of the FN period is not clarified yet, but the stratigraphy and radiocarbon dating of deposits (charcoal) in Trench B1 indicate that Alepotrypa remained in use at least until *c.* 3,200 cal BC (Papathanasiou, this volume; Karkanas, this volume), almost until the end of the FN. However, based on the extant radiocarbon dates from human bones throughout the cave, no human burial dates later than *c.* 3800 cal BC.

The presence of pottery along with radiocarbon dates on charcoal from Trench B1 implies that the cave remained in use until the end of FN, even if not utilised for human burial deposition. People may have kept visiting the place for gatherings and the deposition of material culture into the late FN (*i.e.*, until *c.* 3,200 cal BC). The probably occasional use of the cave until late FN for such depositional practices is also indicated by the pottery found both in the upper layers of Trench B1 (Katsipanou, this volume), as well as by material in Chamber Z. The

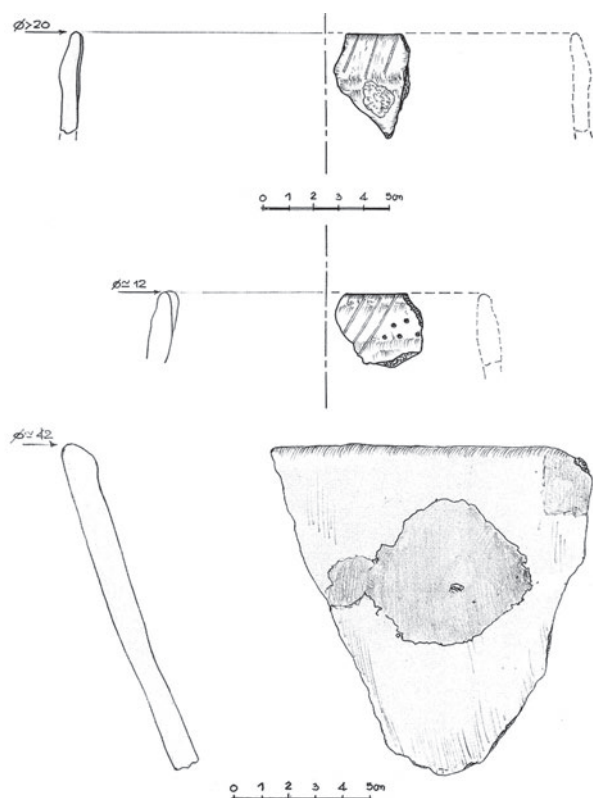


Figure 6.22. Pottery in coarse and med/coarse ware found throughout Chamber Z.

presence of characteristic pottery in Chamber Z, such as the ‘fluted’ and crusted bowls that show affinities with assemblages found in other contexts of a later FN date (late 4th millennium BC), suggests the use of Chamber Z for several activities and visits until the late phase of this period. We cannot at the moment postulate on the use of Chamber Z in the early FN (c. 4,500/4,300–4,100 cal BC), since the pottery present may belong to any part of the FN, as was described by Phelps (2004, 104).

The use of Chamber Z as a place of commitment and investment

All the above musing brings us to the central question: in what kind of activities were the Neolithic people engaged in Chamber Z through the centuries? The picture that the archaeological evidence paints is that of a place characterised by continuous practices of fragmentation and deposition of artefacts that made up the deposits in the niches, whether accompanied by human secondary burials or not. Whether the chamber was a place not actually intended for primary burials, but rather involved in other sorts of deposition of human remains (scattering of bone or secondary burials) during the whole Neolithic period, is a question still left unanswered. Likewise the identity of the people who were picked out for special, secondary treatment and deposition, and when this occurred is open to discussion (see more in Metcalf and Huntington 1991,

33–35, 85–86, 120–122, 144; Helms 1998, 31–32). If Chamber Z was the place where human burial remains from primary burials elsewhere, either inside or outside the cave, were brought in, then a mortuary process comprising several stages of funerary ritual might have been followed. In this case, Chamber Z could have served as the final ‘destination’ of this funerary process and the final locale to where selected human burial remains were transferred (see similar discussion in Byers 2005).

The evidence at Alepotrypa, and Chamber Z in particular, does not imply permanent occupation, but rather it is a place ‘used intermittently for significant social gatherings’ and large-scale ceremonies (Vitelli 1993, 218; 1999, 102), as has been also suggested for Franchthi Cave. These gatherings involved the participation of people probably drawn from a broader geographical area. In this milieu, identities and affiliations may have been expressed through the use of distinctive painted pottery (Vitelli 1993, 216; Kotsakis 2010; Garraty 2013). The communities thus could have made periodic visits to this special disposal area, at some occasion special for them. Once there, as part of the human burial deposition practices or for some other memorial act and mortuary ritual, intentional breakage of items took place (Vitelli 1993, 217–219). The death of the people may have been the occasion for the death of the objects.

A connection between the preponderance of closed vessels and jars with the presence of the lake (and thus the use of water during funerary activities (?), see discussion in Robb *et al.* 2015) is an attractive proposition. These vases do not seem apposite equipment for feasting activities involving solids as part of communal gatherings (Dietler and Hayden 2001), but they would have been quite appropriate vessels for pouring activities, be it water or some other liquid. All in all the picture drawn by the archaeological finds, coupled with the setting and physical space of this particular part of the cave, strongly intimates that the practices of fragmentation and deposition were undertaken as ‘performative acts’ (Renfrew 2007b, 437) in a dark, wet and rocky spot, in the farthest reaches of Alepotrypa Cave – and continued so for thousands of years. The same probably holds true for the lithic material; more than half of the obsidian in Chamber Z is represented by tools in an excellent state of preservation, in contrast to the situation in Trench B1 (Kourtesi-Philippakis, this volume). The tools found in Chamber Z have not been used at all, a situation that probably implies that they too represent another kind of structured act of deposition. Among animal bones, the sample from Chamber Z exhibits less percussion damage and no chopping marks (Hadjikoumis, this volume), while it is also different from the other chambers in its near-absence of cattle, a stronger predominance of sheep/goat, and a lower overall species diversity. The last seems to find an echo in the general lack of diversity in pottery shapes in this area. The presence of the burnt dung (Tsartsidou, this volume;

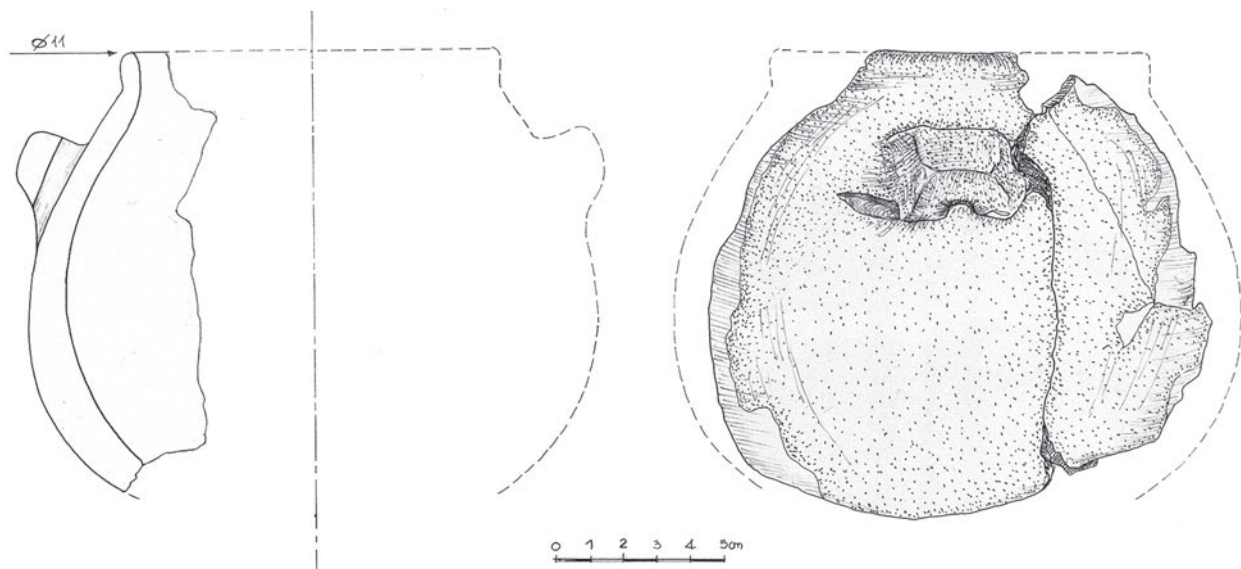


Figure 6.23. Part of a low, collar jar showing affinities with pottery from the Cyclades.

Karkanas, this volume) that probably accompanied these practices could be part of this same process, but further study is required in order to comprehend its depositional process accurately.

One cannot help but wonder if the story thus emerging from the massive volume of the pottery assemblage of Chamber Z, characterised by an intense stylistic variability, is that the pottery may have been ‘killed’. The case of Alepotrypa’s Chamber Z recalls what Colin Renfrew (2007a, 423) rightly observed in the case of the special deposit on the island of Dhaskalio Kavos (Renfrew *et al.* 2007), in the Cyclades: ‘... is it possible that the standard practice was one of a deposition through breakage and that very few objects escaped that fate?’. A clear answer is difficult to find. It is a fact, however, that the assemblage in Chamber Z constitutes the conspicuous consumption of highly stylised vessels (Urfirnis, Matt Painted, Polychrome, as well as the FN Red Slipped pottery) and other artefacts (*e.g.*, obsidian blades), culminating in a conspicuous destruction. This theatre was followed by a final act of deposition by which the objects were removed from the everyday world once and for all (Broodbank 2000, 63). The use of highly and consciously individualised vessels during these activities may have allowed ‘specific local pieces to be recognised and exotic imports to stand out’ (Broodbank 2000, 263).

The activities in Chamber Z are far from random; they seem to represent ‘conscious decisions by particular people to take prestige and designated items out of circulation’ (Broodbank 2000, 264). As has been suggested for other similar cases (*e.g.*, Broodbank 2000, 267–268; Renfrew 2007b, 435–436; see also discussion in David *et al.* 1988), this was probably done to ensure their scarcity and destroy their power in the wider social networks and systems of

values in which the pots themselves were embedded and participating (Appadurai 1986; Kotsakis 1996). These intersecting networks of communication and exchange during the Greek Neolithic probably ‘played a dominant role in the legitimization of social continuity’ (Kotsakis 1996, 170).

Fundamentally, the important attribute of Chamber Z and Alepotrypa Cave is that, despite some discontinuities in the use of space, be they longer or shorter, there appears to be an intriguing continuity in the expression of human activities, since the same practices are repeated down through the years. Such continuity and conservatism argues for a strong connection and commitment to the place, between the people of the past and the people of the present. It was a social arena where there occurred an on-going dialogue between the living, the dead and the ancestors, and at the same time among the living themselves (Helms 1998), conducted through continuous episodes of deposition, through a series of departures and returns to this cave. As Tomkins concludes (2009, 138–140), ‘it is this depositional activity in caves that may further underline their ritual and ancestral importance revealing repeated cycles of investment’. I would like to suggest that it is exactly these acts of deposition in time and space, alongside other activities, that played an important role at the special and central site of Alepotrypa Cave during the Neolithic period in southern Greece.

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Notes

- 1 This paper is a result of two short study seasons in the summers of 2012 and 2013 and should be considered a preliminary presentation. A detailed ceramic analysis, the pottery distribution, and its spatial organization will follow in forthcoming papers by the author, in collaboration with others studying pottery from the cave, Varvara Katsipanou, Giorgos Valvis, Stella Katsarou and Areti Pentedeka (petrographic analysis).
- 2 For the use of caves in previous periods of the Neolithic, see Papathanassopoulos 1996a, 39–40.
- 3 For the use of the darkest zones of caves (usually as ritual spaces) in other parts of the world, see Montello and Moyes 2012.
- 4 As is recorded (Papathanassopoulos 2011, 7 and pers. comm.), one of them, Niche 22, had also been protected by Petrocheilou herself by the construction of a metal door (traces of it are still visible). She was under the impression that the niche was in fact a prehistoric pottery kiln, due to the presence of a massive burnt stratum of broken pottery all over it.
- 5 Apart from the FN vessels and shapes discussed above, pottery of a medium-coarse ware, and specifically collar jars, with low collars and buff surface, appears also in large quantities in Chamber Z. This group probably belongs to the Late Neolithic period, but it is still under study and conservation.
- 6 In the case of the miniature vessel, it is also possible that the red pigment on its interior surface is not part of a decoration, but what remained from a pigment that the vessel contained. Red pigment containers – in some cases of a similar miniature size – have been found in many funerary archaeological contexts, especially in the EBA (e.g., Tsepi and Aghios Kosmas in Attica, see Weiberg 2013, 33–35).
- 7 It is important to note the presence of mending holes that appear on many sherds from Chamber Z, especially in the painted pottery.
- 8 Although the majority of the reconstructed vessels under study had already been conserved at the Diros Museum, after a preliminary examination a distinction between old and new breaks was discernible. A systematic microscopic examination in the future would give reliable indications of the age of the breaks, and in particular of the way this breakage was conducted in the Neolithic period.
- 9 For similar practices of pottery fragmentation, dispersal, and deposition in niches of caves, see discussion in Moyes and Brady 2012, 159 concerning Mesoamerican caves.
- 10 EN and MN sites in Laconia are rare, in contrast to the LN and FN. In the survey of east central Laconia, no sites dated to the EN or MN were located (Cavanagh *et al.* 2002; Cavanagh 2004). In central Laconia, no MN sites other than Kouphovouno, Apidia and Agios Strategos have yet been found (Loughlin 2010, 10–14). In the Diros region, no sites dated before the FN have been located.
- 11 Pottery in the LN Matt Painted ware has been found in central and southern Greece mostly in caves or in open-air pits (e.g., Elateia, Weinberg 1962, 196; Eutresis, Caskey and Caskey 1960; Aria, Dousougli 1998, 138). In many cases the material is associated with burials (e.g., Lerna, Vitelli 2007), sometimes also found alongside FN pottery (e.g., Acropolis North Slope well, Immerwahr 1971, 21, pl. 7). The cases where this pottery is found in purely domestic contexts are rare (e.g., Halai, Coleman 1992; Merenda Attica, Kakavogianni *et al.* 2009). See discussion on the chronological implications of this ware in Vitelli 2007, 115–116.
- 12 Polychrome pottery characterizes the LN period in the southern Greek mainland and, as with the Matt Painted ware, is also usually connected with many caves (e.g., Franchthi, Sarakenos, of Euripides, Korycian, of Pan, etc), open-air pits, in many cases along with FN pottery (e.g., Prosymna pits, Blegen 1937; Lerna pits, Caskey 1957, fig. 48a; Caskey 1958, 136–137; Chonika Argolid, Dousougli 1998, 111, n. 223) or even with EH I pottery (e.g., Tsoungiza EH I pit, Pullen 2011, 29). Its use until the early FN has

been stressed by some scholars (Vitelli 1999 and 2007, 111–112, 115, 124; Phelps 2004, 103, 125) both in the southern Greek mainland, as well as in Thessaly (e.g., FN pits in Rachmani, Toufexis 1997, 509).

Bibliography

- Aram-Stern, E. (1996) *Die Ägäische Frühzeit, 2. Serie Forschungsbericht 1975–1993, 1. Band Das Neolithikum in Griechenland mit Ausnahme von Kreta und Zypern*. Vienna.
- Andreadaki-Vlazaki, M. (ed.) (2102) 2000–2010. *Από το ανασκαφικό έργο των Εφορειών Αρχαιοτήτων*. Athens.
- Andreou, S., Fotiadis, M. and Kotsakis, K. (1996) Review of Aegean prehistory. V: The Neolithic and Bronze Age of northern Greece. *American Journal of Archaeology* 100, 537–597.
- Appadurai, A. (1986) Introduction: commodities and the politics of value. In A. Appadurai (ed.) *The Social Life of Things: Commodities in Cultural Perspective*, 3–62. Cambridge.
- Blegen, C. W. (1930–1931) Gonia. *Metropolitan Museum Studies* 3, 55–80.
- Blegen, C. W. (1937) *Prosymna. The Helladic Settlement Preceding the Argive Heraeum*. Cambridge.
- Bonga, L. (2013) *Late Neolithic Pottery from Mainland Greece, c. 5,300–4,300 B.C.* Unpublished PhD dissertation, Temple University.
- Bradley, R. (2000) *An Archaeology of Natural Places*. London.
- Broodbank, C. (2000) *An Island Archaeology of the Early Cyclades*. Cambridge.
- Byers, M. A. (2005) The Mortuary ‘Laying-In’ Crypts of the Hopewell Site. Beyond the Funerary Paradigm. In G. F. M. Rakita, J. E. Buikstra, L. A. Beck, and S. R. Williams (eds) *Interacting with the Dead. Perspectives on Mortuary Archaeology for the New Millennium*, 124–141. Florida.
- Caskey, J. L. (1957) Excavations at Lerna, 1956. *Hesperia* 26, 142–162.
- Caskey, J. L. (1958) Excavations at Lerna, 1957. *Hesperia* 27, 125–144.
- Caskey, J. L. and Caskey E. G. (1960) The earliest settlements at Eutresis: supplementary excavations, 1958. *Hesperia* 29, 126–167.
- Cavanagh, W. (2004) WYSIWYG: Settlement and territoriality in southern Greece during the Early and Middle Neolithic periods. *Journal of Mediterranean Archaeology* 17, 165–189.
- Cavanagh, W., Crowel, J., Catling, R. W. V. and Shipley, G. (2002) *Continuity and Change in a Greek Rural Landscape: The Laconia Survey. 1: Methodology and Interpretation*. (British School at Athens Supplement 26). London.
- Cavanagh, W. and Mee, C. (2005) Reflections on Neolithic Laconia. In A. Dakouri-Hild (ed.) *Autochthon. Papers Presented to O.T.P.K. Dickinson on the Occasion of his Retirement*, 24–36. (British Archaeological Report S1432). Oxford.
- Chapman, J. (2000) *Fragmentation in Archaeology. People, Places and Broken Objects in the Prehistory of South-Eastern Europe*. London and New York.
- Chapman, J. (2008) Object fragmentation and past landscapes. In B. David and J. Thomas (eds) *Handbook of Landscape Archaeology*, 187–201. Walnut Creek.
- Chapman, J. and Gaydarska, B. (2007) *Parts and Wholes: Fragmentation in Prehistoric Context*. Oxford.
- Coleman, J. E. (1977) *Keos 1. Kephala: A Late Neolithic Settlement and Cemetery*. Princeton.
- Coleman, J. E. (1992) Excavations at Halai, 1990–1991. *Hesperia* 61, 265–289.
- Coleman, J. E. (2011) The Petromagoula-Doliana group and the beginning of the Aegean Early Bronze Age. In D. Katsonopoulou (ed.) *Helike IV. Ancient Helike and Aigialeia. Protohelladika. The Southern and Central Greek Mainland*, 13–44. Athens.
- Cullen, T. (1985) Social implications of ceramic style in the Neolithic Peloponnese. In W. D. Kingery (ed.) *Ancient Technology to Modern Science, Ceramics and Civilization*, 77–100. Columbus.
- Cullen, T. (1999) Scattered human bones at Franchthi cave: remnants of ritual or refuse? In P. P. Betancourt, V. Karageorghis, R. Laffineur and W.-D. Niemeier (eds) *Meletemata, Studies in Aegean Archaeology Presented to Malcolm H. Wiener as He Enters his 65th year*, 165–171. (Aegeum 20). Liège and Austin.
- David, N., Sterner, J. and Gavua, K. (1988) Why pots are decorated. *Current Anthropology* 29, 365–389.
- Demoule, J.-P. and Perlès, C. (1993) The Greek Neolithic: a new review. *Journal of World Prehistory* 7, 355–416.
- Diamant, S. (1974) *The Later Village Farming Stage in Southern Greece*. Unpublished PhD dissertation, University of Pennsylvania.
- Dietler, M. and Hayden, B. (eds) (2001) *Feasts: Archaeological and Ethnographic Perspectives on Food, Politics and Power*. Washington and London.
- Dousougli, A. (1998) *Άρια Αργολίδος. Χειροποίητη κεραμική της Νεότερης Νεολιθικής και της Χαλκολιθικής περιόδου*. (Archaiologikon Deltion Δημοσιεύματα 66). Athens.
- Dousougli, A. and Zachos, K. (2002) L’archéologie des zones montagneuses: modèles et interconnexions dans le Néolithique de l’Épire et de l’Albanie méridionale. In G. Touchais and J. Renard (eds) *L’Albanie dans l’Europe préhistorique. Actes du Colloque de Lorient, 8–10 Juin 2000*, 111–143. (Bulletin de correspondance hellénique: Supplément 42). Paris.
- Diressen, J. (ed.) (2013) *Destruction. Archaeological, Philological and Historical Perspectives*. Louvain-la-Neuve.
- Facorellis, Y. and Coleman, J. E. (2012) Interpreting radiocarbon dates from Neolithic Halai, Greece. *Radiocarbon* 54, 319–330.
- French, D. H. (1972) *Notes on Prehistoric Pottery Groups from Central Greece*. Athens.
- Garraty, C. P. (2013) Social identity and political competition in a culturally diverse landscape: decorated pottery from the Mescal Wash site in Southeastern Arizona. *Journal of Arizona Archaeology*, 2, 163–177.
- Halstead, P. (1994) The North-South divide: regional paths to complexity in prehistoric Greece. In C. Mathers and S. Stoddart (eds) *Development and Decline in the Mediterranean Bronze Age*, 195–219. (Sheffield Archaeological Monographs 8). Sheffield.
- Halstead, P. (1995) From sharing to hoarding: the Neolithic foundations of Aegean Bronze Age society. In R. Laffineur and W. D. Niemeier (eds) *Politeia: Society and State in the Aegean Bronze Age. Proceedings of the 5th International Aegean Conference, University of Heidelberg, Archäologisches Institut, 10–13 April 1994*, 11–21. (Aegaeum 12). Liège.

- Halstead, P. (1999) Neighbours from hell? The household in Neolithic Greece. In P. Halstead (ed.) *Neolithic Society in Greece*, 77–95. (Sheffield Studies in Aegean Archaeology 2). Sheffield.
- Hamilakis, Y. (1998) Eating the dead: mortuary feasting and the politics of memory in the Aegean Bronze Age Societies. In K. Branigan (ed.) *Cemetery and Society in the Aegean Bronze Age*, 115–132. (Sheffield Studies in Aegean Archaeology 1). Sheffield.
- Helms, M. W. (1998) *Access to Origins. Affines, Ancestors and Aristocrats*. Austin.
- Immerwahr, S. A. (1971) *The Athenian Agora XIII. The Neolithic and Bronze Ages*. Princeton.
- Jacobsen, T. W. and Cullen, T. (1981) A consideration of mortuary practices in Neolithic Greece: burials from Franchthi Cave. In S. C. Humphreys and H. King (eds) *Mortality and Immortality. The Anthropology and Archaeology of Death*, 79–101. London.
- Johnson, M. (1999) Chronology of Greece and south-east Europe in the Final Neolithic and Early Bronze Age. *Proceedings of the Prehistoric Society* 65, 319–336.
- Kakavogianni, O., Tselepi, E. and Katsavou, C. (2009) Οικισμός της Αρχαιότερης Νεολιθικής και οικία της Νεότερης Νεολιθικής εποχής στη Μερέντα. In V. Vassilopoulou and S. Katsarou-Tzeveleki (eds) *Από τα Μεσόγεια στον Αργοσαρωνικό. Β' Εφορεία Προϊστορικών και Κλασικών Αρχαιοτήτων. Το έργο μιας δεκαετίας, 1994–2003. Πρακτικά Συνεδρίου, Αθήνα, 18–20 Δεκεμβρίου 2003*, 143–158. Athens.
- Karali, L. (1998) Τα όστρεα και οι χρήσεις τους στο σπήλαιο Αλεπότρυπα Μάνης. In E. Kypraiou (ed.) *Πρακτικά του πρώτου Πανελληνίου Σπηλαιολογικού Συνεδρίου Άνθρωπος και Σπηλαιοπεριβάλλον (26–29 Νοεμβρίου 1992)*, 107–114. Athens.
- Kotsakis, K. (1996) Exchanges and relations. In G. Papathanassopoulos (ed.) *Neolithic Culture in Greece*, 168–170. Athens.
- Kotsakis, K. (2010) Η κεραμική της Νεότερης Νεολιθικής στη Βόρεια Ελλάδα. In N. Papadimitriou and Z. Tsirtsoni (eds) *Η Ελλάδα στο ευρύτερο πλαίσιο των Βαλκανίων κατά την 5^η και 6^η χιλιετία π.Χ.*, 67–75. Athens.
- Lambert, N. (1972) Grotte d'Alépotrypa (Magne). *Bulletin de correspondance hellénique* 96, 845–871.
- Loughlin, T. (2010) *Technological Choices in Forming Traditions in Middle Neolithic Ceramics from the Peloponnese, Greece*. Unpublished PhD thesis, University of Liverpool.
- Maran, J. (1998) *Kulturwandel auf dem griechischen Festland und den Kykladen im späten 3. Jahrtausend v. Chr. Studien zu den kulturellen Verhältnissen in Südosteuropa und dem zentralen sowie östlichen Mittelmeerraum in der späten Kupfer- und frühen Bronzezeit*. (Universitätsforschungen zur prähistorischen archäologie 53). Bonn.
- Mari, A. (2001) *Η νεολιθική εποχή στο Σαρωνικό*. Unpublished PhD thesis, University of Thessaloniki.
- Mavridis, F. (2008) Late Neolithic Painted and Burnished Decorated Wares. In A. Sampson, *The Cave of the Cyclops: Mesolithic and Neolithic Networks in the Northern Aegean, Greece I: Intra-Site Analysis, Local Industries, and Regional Site Distribution*, 111–122. (Prehistory Monographs 21). Philadelphia.
- Mavridis, F. (2010) Salvage excavation in the cave of Antiparos, Cyclades. Prehistoric pottery and miscellaneous finds: a preliminary report. *Aegean Archaeology* 9, 7–34.
- Metcalfe, P. and Huntington, R. (1991) *Celebrations of Death: The Anthropology of Mortuary Ritual*, 2nd edition, Cambridge.
- Moyes, H. (ed.) (2012) *Sacred Darkness. A Global Perspective on the Ritual Use of Caves*. Boulder.
- Montello, D. R. and Moyes, H. (2012) Why dark zones are sacred. Turning to behavioral and cognitive sciences for answers. In H. Moyes (ed.), *Sacred Darkness. A Global Perspective on the Ritual Use of Caves*, 385–396. Boulder.
- Moyes, H. and Brady, J. E. (2012) Caves as sacred space in Mesoamerica. In H. Moyes (ed.), *Sacred Darkness. A Global Perspective on the Ritual Use of Caves*, 151–170. Boulder.
- Nakou, G. (1995) The cutting edge: a new look at early Aegean metallurgy. *Journal of Mediterranean Archaeology* 8, 1–32.
- Pantelidou-Gofas, M. (1998) Πρώιμη κεραμική από το νεκροταφείο Τσέπι Μαραθώνος. In *Η προϊστορική έρευνα στην Ελλάδα και οι προοπτικές της. Θεωρητικοί και μεθοδολογικοί προβληματισμοί. Πρακτικά διεθνούς συμποσίου στη μνήμη του Δ. Ρ. Θεοχάρη. Θεσσαλονίκη-Καστοριά 26–28/11/1998*, 249–254. Thessaloniki.
- Pantelidou-Gofas, M. (2007) Marathon. Tsepi. *Ergon*, 13–20.
- Pantelidou-Gofas, M. (2008) The deposit pit at Tsepi, Marathon: features, formation and the breakage of the finds. In N. Brodie, J. Doole, G. Gavalas and C. Renfrew (eds) *Horizon: A Colloquium on the Prehistory of the Cyclades, Cambridge 25–28 March 2004*, 281–289. Cambridge.
- Papadatos, Y., Tomkins, P., Nodarou, E. and Iliopoulos, Y. (in press) The beginning of the Early Bronze Age in Crete: continuities and discontinuities in the ceramic assemblage at Kephala Petras, Siteia. In C. Dumas, A. Giannikouri, and O. Kouka (eds) *The Aegean Early Bronze Age: New Evidence. International Conference, Athens, April 11th–14th 2008*. Athens.
- Papathanasiou, A. (1999) *A Bioarchaeological Analysis of Health, Subsistence and Funerary Behavior in the Eastern Mediterranean Basin: A Case Study from Alepotrypa Cave, Southern Greece*. Unpublished PhD dissertation, University of Iowa.
- Papathanasiou, A. (2001) *A Bioarchaeological Analysis of Neolithic Alepotrypa Cave, Greece*. (British Archaeological Report S961). Oxford.
- Papathanasiou, A. (2009) Mortuary behavior in the Alepotrypa Cave: assessments from the study of the human osteological material. In W. G. Cavanagh, C. Gallou and M. Georgiadis (eds) *Sparta and Laconia: From Prehistory to Pre-modern. Proceedings of the Conference Held in Sparta, Organised by the British School at Athens, the University of Nottingham, the 5th Ephoreia of Prehistoric and Classical Antiquities and the 5th Ephoreia of Byzantine Antiquities, 17–20 March 2005*, 21–28. (British School at Athens Studies 16). London.
- Papathanasiou, A., Karkanas, P., Katsarou, S., Valvis, G., Psimogiannou, K. and Tsartsidou, G. (2013) Alepotrypa Cave, Diros, 6000–3500 BC: new evidence sheds new light on the excavated material. *Paper presented at the International Conference Communities in Transition: The Circum-Aegean Later Neolithic Stages (c. 5000/4800–3200/3000 B.C.), Conference held at the Athens Acropolis Museum and the Danish Institute in Athens, 7–9 June 2013*. Athens.
- Papathanassopoulos, G. A. (1971) Σπήλαια Διρού, 1971. *Archaiologika Analekta ex Athenon/Athens Annals of Archaeology* 4, 12–26, 149–154, 289–304.
- Papathanassopoulos, G. A. (1992) Νεολιθικά τεχνικά έργα στο σπήλαιο Αλεπότρυπα Διρού Μάνης. *Πρακτικά του*

- Α' Συμποσίου Αρχαιομετρίας "Σύνδεση Αρχαιομετρίας και Αρχαιολογίας", 26–28 Ιανουαρίου 1990, 43–52. Athens.
- Papathanassopoulos, G. A. (1996) *Neolithic Culture in Greece*. Athens.
- Papathanassopoulos, G. A. (1996a) Habitation in caves. In G. A. Papathanassopoulos, *Neolithic Culture in Greece*, 39–41. Athens.
- Papathanassopoulos, G. A. (1996b) Neolithic Diros: The Alepotrypa cave. In G. A. Papathanassopoulos, *Neolithic Culture in Greece*, 80–84. Athens.
- Papathanassopoulos, G. A. (1996c) Burial customs at Diros. In G. A. Papathanassopoulos, *Neolithic Culture in Greece*, 175–177. Athens.
- Papathanassopoulos, G. A. (2011) *Το Νεολιθικό Διρό: Σπήλαιο Αλεπότρυπα*. Athens.
- Pappa, M., Halstead, P., Kotsakis, K. and Urem-Kotsou, D. (2004) Evidence for large-scale feasting at Late Neolithic Makriyalos, northern Greece. In P. Halstead and J. C. Barrett (eds) *Food, Cuisine and Society in Prehistoric Greece*, 16–44. (Sheffield Studies in Aegean Archaeology 5). Oxford.
- Parker Pearson, M. (1999/2003) *The Archaeology of Death and Burial*. Phoenix Mill.
- Parkinson, W. A., Papathanasiou, A., Galaty, M. L., Pullen, D. J., Karkanas, P. and Papathanassopoulos, G. (2015) Diros in context: Alepotrypa Cave and Ksagounaki Promonotory in the Neolithic Period. In A. Sarris, E. Kalogiropoulou, T. Kalayci, and L. Karimali (eds) *Communities, Landscapes, and Interaction in Neolithic Greece*, 125–135. (International Monographs in Prehistory, Archaeological Series 20). Ann Arbor.
- Perlès, C. and Vitelli, K. D. (1999) Craft specialization in the Neolithic of Greece. In P. Halstead (ed.) *Neolithic Society in Greece*, 96–107. (Sheffield Studies in Aegean Archaeology 2). Sheffield.
- Petrocheilos, I. (1958) Σπηλαιολογικά έρευνα εις την περιοχήν Δυρού Λακωνίας. *Δελτίον Ελληνικής Σπηλαιολογικής Εταιρείας*, τόμος IV, τεύχος 5–6, 57–97. Αθήναι.
- Phelps, W. W. (1975) *The Neolithic Pottery Sequence in Southern Greece*. Unpublished PhD dissertation, University of London.
- Phelps, W. W. (2004) *The Neolithic Pottery Sequence in Southern Greece*. (British Archaeological Reports S1259). Oxford.
- Platon, N. (1968) 'Εργασίαι διαμορφώσεως και τακτοποιήσεως του αρχαιολογικού χώρου Ακροπόλεως. *Archaiologikon Deltion* 21, *Chronika* B1, 36–44.
- Psimogiannou, K. (2008) *Η νεολιθική εγκατάσταση στον Προσκυνά Φθιώτιδος*. Unpublished Masters thesis, Aristotle University of Thessaloniki.
- Psimogiannou, K. (2012) Creating identities in the mortuary arena of the Greek Final Neolithic: a contextual definition of practices in central and southern Greece. *Documenta Praehistorica* 39, 185–201.
- Psimogiannou, K. (2017) Fluid landscapes, bonded people? The role of burial areas as places for interaction, exchange and deposition during the Final Neolithic period in central and southern Greece. In A. Sarris, E. Kalogiropoulou, T. Kalayci, and L. Karimali (eds) *Communities, Landscapes, and Interaction in Neolithic Greece*, 198–215. (International Monographs in Prehistory, Archaeological Series 20). Ann Arbor.
- Pullen, D. J. (2011) *The Early Bronze Age Village on Tsoungiza Hill. Nemea Valley Archaeological Project 1*. Princeton.
- Rammou, A. (2009) *Αγγεία καθημερινής χρήσης από το σπήλαιο Αλεπότρυπα Διρού Λακωνίας*. Unpublished PhD thesis, University of Thessaloniki.
- Renfrew, C. (1972) *The Emergence of Civilization. The Cyclades and the Aegean in the Third Millennium B.C.* London.
- Renfrew, C. (2007a) Thraumatology. In C. Renfrew et al. (eds) *Keros, Dhaskalio Kavos, the Investigations of 1987–88*, 1, 405–428. Cambridge.
- Renfrew, C. (2007b) Dhaskalio Kavos as symbolic attractor. In C. Renfrew, C. Doumas, L. Marangou and G. Gavalas (eds) *Keros, Dhaskalio Kavos, the Investigations of 1987–88*, 1, 429–442. Cambridge.
- Renfrew, C., Boyd, M. and Ramsey, C. B. (2012) The oldest maritime sanctuary? Dating the sanctuary at Keros and the Cycladic Early Bronze Age. *Antiquity* 86, 144–160.
- Renfrew, C., Doumas, C., Marangou, L. and Gavalas, G. (eds) (2007) *Keros, Dhaskalio Kavos, the Investigations of 1987–88*, 1. Cambridge.
- Robb, J., Elster, E. S., Isetti, E., Knüsel, C. J., Tafuri, M. A. and Traverso, A. (2015) Cleaning the dead: Neolithic ritual processing of human bone at Scaloria Cave, Italy. *Antiquity* 89, 39–54.
- Runnels, C. N. and van Andel, T. H. (1987) The evolution of settlement in the southern Argolid, Greece: an economic explanation. *Hesperia* 56, 303–334.
- Sampson, A. (1993) *Σκοτεινή Θαρρουνίων. Το σπήλαιο, ο οικισμός και το νεκροταφείο*. Athens.
- Sampson, A. (2008) *The Sarakenos Cave at Akraephion, Boeotia, Greece, I: The Neolithic and the Bronze Age. Pottery Analysis, Cave Occupation Patterns and Population Movements in Central and Southern Greece. I: The research from 1994–2000*. Athens.
- Sampson, A. and Katsarou, S. (1998). Ανασκαφή στο σπήλαιο Λιμνών στα Καστριά Καλαβρύτων κατά το έτος 1992. In E. Κυπραίου (ed.) *Πρακτικά του πρώτου Πανελληνίου Σπηλαιολογικού Συνεδρίου Άνθρωπος και Σπηλαιοπεριβάλλον, (26–29 November 1992)*, Athens, 63–68. Athens.
- Sampson, A. and Mastrogiannopoulou, V. (2017) Late Neolithic traditions: new evidence from the cave of Sarakenos, Kopais. In S. Dietz, F. Mavridis and J. Tankosiz (eds) *Communities in Transition. The Circum-Aegean Area in the 5th and 4th Millennia BC*. Oxford.
- Schoep, I. and Tomkins, P. (2012) Back to the beginning for the Early and Middle Bronze Age on Crete. In I. Schoep, P. Tomkins and J. Driessen (eds) *Back to the Beginning. Reassessing Social and Political Complexity on Crete during the Early and Middle Bronze Age*, 1–31. Oxford.
- Skeates, R. (2012) Constructed caves: transformations of the underworld in prehistoric Southeast Italy. In H. Moyes (ed.) *Sacred Darkness: A Global Perspective on the Ritual Use of Caves*, 27–44. Boulder.
- Stratouli, G. (1998) Η ανάγνωση των χρήσεων των σπηλαίων στη Νεολιθική Ελλάδα: εμπειρικές και διεπιστημονικές προσεγγίσεις. In E. Κυπραίου (ed.) *Πρακτικά του Πρώτου Πανελληνίου Σπηλαιολογικού Συνεδρίου Άνθρωπος και Σπηλαιοπεριβάλλον, (26–29 November 1992)*, Athens, 59–62. Athens.
- Stratouli, G. (2005) Symbolic behavior at places of social activity beyond the domestic area in the Ionian Neolithic. *Documenta Praehistorica* 32, 123–132.
- Stroulia, A. (2003) Ground stone celts from Franchthi Cave: a close look. *Hesperia* 72, 1–30.

- Stroulia, A. and Chondrou, D. (2013) Destroying the means of production: the case of ground stone tools from Kremasti-Koilada, Greece. In J. Driessen (ed.) *Destruction: Archaeological, Philological and Historical Perspectives*, 109–131. Louvain-la-Neuve.
- Talalay, L. (1993) *Deities, Dolls and Devices: Neolithic Figurines from Franchthi Cave*. (Excavations at Franchthi Cave, Greece, Fascicle 9). Bloomington and Indianapolis.
- Thomas, J. (2001) Archaeologies of place and landscape. In I. Hodder (ed.) *Archaeological Theory Today*, 165–186. Cambridge.
- Tilley, C. Y. (1994) *A Phenomenology of Landscape. Places, Paths and Monuments*. Oxford.
- Tomkins, P. (2007) Communality and competition: the social life of food and containers at Aceramic and Early Neolithic Knossos, Crete. In C. Mee and J. Renard (eds) *Cooking up the Past. Food and Culinary Practices in the Neolithic and Bronze Age Aegean*, 174–199. Oxford.
- Tomkins, P. (2009) Domesticity by default. Ritual, ritualization and cave-use in the Neolithic Aegean. *Oxford Journal of Archaeology* 28, 125–153.
- Tomkins, P. (2012) Landscapes of identity, ritual and memory. Reconsidering the use of caves during the Neolithic and Early Bronze Age. In H. Moyes (ed.) *Sacred Darkness: A Global Perspective on the Ritual Use of Caves*, 59–79. Boulder.
- Tomkins, P. (2014) Tracing complexity in ‘the Missing Millenium’: an overview of recent research into the Final Neolithic period of Crete. In B. Horejs and M. Mehofer (eds) *Western Anatolia before Troy. Proto-Ubranization in the 4th millennium BC? Proceedings of the International Symposium held at Kunsthistorisches Museum Wien, Vienna Austria, 21–24 November, 2012*, 345–364. Vienna.
- Tomkins, P. and Schoep, I. (2010) The Early Bronze Age in Crete. In E. Cline (ed.) *The Oxford Handbook for the Bronze Age Aegean*, 66–82. Oxford.
- Toufexis, G. (1997) Recent Neolithic research in the Eastern Thessalian plain, Greece. In H. Erkanal and H. Hauptmann (eds) *The Aegean in the Neolithic, Chalcolithic and the Early Bronze Age. Proceedings of the International Symposium, October 13th–19th, 1997, Urla-Ýzmir (Turkey)*, 569–579. Ankara.
- Triantafyllou, S. (1999) Prehistoric Makriyalos: a story from the fragments. In P. Halstead (ed.) *Neolithic Society in Greece*, 128–135. (Sheffield Studies in Aegean Archaeology 2). Sheffield.
- Tzevelekidi, V. (2013) *Dressing for Dinner: Butchery and Bone Deposition at Late Neolithic Toumba Kremastis-Koiladas, Northern Greece*. (British Archaeological Reports S2451). Oxford.
- van Andel, T. H. and Runnels, C. N. (1988) An essay on ‘the emergence of civilization’ in the Aegean world. *Antiquity* 62, 234–247.
- van Andel, T. H., Runnels, C. N. and Pope, K. (1986) Five thousand years of land use and abuse in the southern Argolid, Greece. *Hesperia* 55, 103–128.
- Vitelli, K. D. (1993) *Franchthi Neolithic Pottery, 1: Classification and Ceramic Phases 1 and 2*. (Excavations at Franchthi Cave, Greece, fascicle 8). Bloomington.
- Vitelli, K. D. (1995) Pots, potters and the shaping of Greek Neolithic society. In W. K. Barnett and J. W. Hoopes (eds) *The Emergence of Pottery: Technology and Innovation in Ancient Societies*, 55–63. Washington and London.
- Vitelli, K. D. (1999) *Franchthi Neolithic Pottery, 2: The Later Neolithic Ceramic Phases 3 to 5* (Excavations at Franchthi cave, Greece, fascicle 10). Bloomington.
- Vitelli, K. D. (2007) *The Neolithic Pottery from Lerna*. (Lerna V). Princeton.
- Weiberg, E. (2013) An Early Helladic burial – connecting the living and the dead. In A.-L. Schallin (ed) *Perspectives on Ancient Greece. Papers in Celebration of the 60th anniversary of the Swedish Institute at Athens*. (Acta Instituti Atheniensis Regni Sueciae, Series In 8, 22), 29–47. Stockholm.
- Weinberg, S. S. (1962) Excavations at prehistoric Elateia, 1959. *Hesperia* 31, 158–209.
- Wells, B., Runnels, C. and Zangger, E. (1990) The Berbati-Limnes archaeological survey: the 1988 season. *Opuscula Atheniensia* 18, 207–238.
- Wickens, J. (1986) *The Archaeology and History of Cave Use in Attica, Greece from Prehistoric through Late Roman Times*. Unpublished PhD thesis, Indiana University.
- Zachos, K. L. (1987) *Ayios Dimitrios. A Prehistoric Settlement in Southwestern Peloponnesos: The Neolithic and Early Helladic Periods*. Unpublished PhD dissertation, Boston University.
- Zachos, K. L. (1998) Σπηλαιοκατοίκηση στην Πελοπόννησο κατά τη Νεότερη Νεολιθική περίοδο. In E. Κυπραίου (ed.) *Πρακτικά του Πρώτου Πανελληνίου Σπηλαιολογικού Συνεδρίου Άνθρωπος και Σπηλαιοπεριβάλλον*, (26–29 Νοεμβρίου 1992), 53–58. Athens.
- Zachos, K. L. (1999) Zas cave on Naxos and the role of caves in the Aegean Late Neolithic. In P. Halstead (ed.) *Neolithic Society in Greece*, 153–163. (Sheffield Studies in Aegean Archaeology 2). Sheffield.
- Zachos, K. L. and Dousougli, A. (in press) Attica and the Cyclades from the Chalcolithic to the Early Bronze Age. In C. Doumas, A. Giannikouri and O. Kouka (eds) *The Aegean Early Bronze Age: New Evidence. International Conference, Athens, April 11th–14th, 2008*. Athens.

Pithoi with relief decoration from Alepotrypa Cave

George Valvis

Introduction

More than 4,500 sherds of pithoi vessels (large and tall, coarse-ware ceramic storage jars) have been found in the excavations of Alepotrypa Cave. Many fragments were collected as surface finds by speleologists during the exploration of the cave in the 1960s (Papathanassopoulos 2011, 52). Although a certain number of these sherds (about 1,000) belong to smaller pithoid vessels, it is evident that pithoi were in heavy use. Their primary role as repositories of materials was of central importance among the activities that took place inside the cave.

Pithoi in Greek history

In a discussion of pithoi and their multiple functions throughout Greek history T. Cullen and D. Keller pointed out the dual character with which pithoi were associated from time to time: storage of goods, but also with the afterlife or the underworld, through their use as burial containers (Cullen and Keller 1990).

In the Early Bronze Age, pithoi were used to store foodstuffs, as for example in the storage areas in the settlement of Myrtos, Crete (Warren 1972, 18, 48–50), but they also served for burials of children and adults at Platanos and Vorou, Crete (Branigan 1970, 11; Marinatos 1931, 137–170). During the Middle and Late Bronze Ages, numerous pithoi and their fragments are known from palace sites and the areas in their immediate surroundings. From the West Magazine at Knossos about 420 pithoi are reported (Graham 1962, 129–137) and at least eight pithoi were found in the House of the Wine Merchant at Mycenae, many others at Pylos (Wace 1953, 9–18; Blegen and Rawson 1966, 12, 16). All these pithoi are associated with storage purposes and often viewed as evidence of control of products' distribution by a palatial central elite to other members of their society. In Archaic

times, specific workshops in Boeotia, Tenos, and Rhodes produced the well-known 'relief pithoi', decorated with themes very often drawn from mythology (Caskey 1976, 19–41). In later times broken fragments of pithoi have been reused in the making of chimneys, as filling material in walls or as a base for a hearth. As a pottery shape it has survived until today.

To return to the Neolithic and its Late and Final periods in particular in southern Greece and the Aegean, pithoi are found in both open-air sites (*e.g.*, the cemetery of Kephala at Kea (Coleman 1977), the settlement of Ayios Dimitrios in Messenia (Zachos 1987) and the Athenian Agora (Immerwahr 1971), but also in caves (the Cave of Lakes in Arcadia (Sampson 1997), at Tharrounia (Sampson 1992, 61–101) in Euboea and at many others). In fact, it is in cave sites in particular that their presence is noted in emphatically large numbers, as is the case with Alepotrypa.

Characteristics of the Alepotrypa pithoi

General

The fabric of the Alepotrypa pithoi is coarse, and generally quite hard. Most of the sherds do not break easily, a fact that indicates that they were fired in relatively high temperatures. The firing of the clay is even in most cases, with only 20% having black or dark grey cores. They were almost certainly formed and fired outside the cave, since there is no indication of such activities inside Alepotrypa until now (for example, no tools exist for working with clay nor structures that might have served as pottery kilns). Surface colours range from red to light/dark brown (2.5YR to 7.5YR, Munsell color charts, rev. ed. 1994). The vast majority of Alepotrypa pithoi were heavily tempered. Grog, calcite and quartzite were identified macroscopically. Some inclusions are up to 9 mm in

diameter, but generally such diameters range from 4 mm to 7 mm. Two broad categories of surface treatment were distinguished: a) rough surfaces with no other treatment, and b) surfaces that bear a slip similar to the colour of the clay, or dark brown. About 10% of the sherds were slightly burnished. All pithoi fragments were decorated or belong to pots with relief decoration.

Decoration

Relief work has been used for decorating both small and medium-sized vases in Alepotrypa (Δ. 640, Δ. 648, Δ. 1307 to mention only a few small vases; Papathanassopoulos 1996, 218, 222), as well as larger coarse vessels. Pithoi are almost exclusively decorated in that method. One could argue that paint or any other type of decoration available within the Neolithic ceramic tradition/‘repertoire’ is for some reason considered as not ‘applicable’ to pithoi.

The use of clay relief bands on pithoi, apart from the aesthetic effect that it produces as a decorative theme, also serves for strengthening the body of the vessel, adds to its firmness and limits the possibilities of accidental breakage. The plastic bands were in most cases applied directly on the pot surfaces while still in a plastic state, before it was fired. In a few cases, especially in sherds that carried only one or very few simple bands, a variation of the above method was practised: the plastic band was created by pinching up a certain amount of clay, working or squeezing it so as to produce a strip in relief (perhaps with the addition of some more clay if needed), and finally smoothing the junction where the band meets the surface so as to make these points almost invisible. Sometimes the two methods were combined on the same pot.

In an attempt to emphasise the popularity of this style of decoration and the similarities of decorative motifs among contemporary sites during the Late and Final Neolithic periods, Phelps notes: ‘relief or plastic decoration in Greece is so universal at this time that it cannot by itself be used to demonstrate chronological relationships’ (2004, 331).

Two broad categories of plastic bands were initially distinguished: A. simple, thin (3–5 mm in width) bands with no other further treatment. These are either semi-circular, rectangular or triangular in profile; and B. thick clay bands (sometimes up to 1 cm in width) that bear marks either of rounded tools/fingertips or incisions that are cut vertically or in an oblique manner on the pot’s surface. The marks are applied in a consecutive, horizontal, repetitive scheme along the whole of the relief band, at short, regular intervals. Further consideration of the manner in which these categories of bands were actually distributed (or ‘spaced’) upon the surface of the vessel shows that the following divisions were created (names of different typological sub-groups are in Greek, *i.e.*, Av = relief, and a number is assigned to each group):

- A. Simple, thin bands, semi-rounded, rectangular or triangular in profile with no other further treatment.
 - A1) One or few simple horizontal, vertical or diagonal bands (semi-rounded, rectangular or triangular in profile) that are dispersed sparsely or freely on the surface. Group Av 1; Group Av 2; Group Av 3 (CPII 15)
 - A2) Consecutive horizontal, vertical or diagonal bands (semi-rounded, rectangular or triangular in profile) applied more densely, thus covering larger areas of the vessel. Group Av 4; Group Av 5; Group Av 6 (CPII 16 and 17)
 - A3) Systems of horizontal, vertical or diagonal bands (semi-rounded, rectangular or triangular in profile), sometimes intersecting each other, creating rectangular, triangular or other more complex designs. Group Av 7; Group Av 8; Group Av 9; Group Av 10; Group Av 11 (CPII 18 and 19)
- B. Thick clay bands (sometimes up to 1 cm in width) that bear rounded or oval-shaped marks (executed by circular tools/fingertips) or incisions, cut vertically or in an oblique manner. These marks are applied in a consecutive, horizontal, repetitive scheme along the whole of the relief band, in short, regular intervals.
 - B1) One or few horizontal, vertical or diagonal bands that bear rounded or oval shaped marks or fingerprints dispersed sparsely or freely on the surface. Group Av 13; Group Av 14; Group Av 15; Group Av 16; Group Av 17 (CPII 20 and 21)
 - B2) Consecutive horizontal, vertical or diagonal bands that bear rounded or oval shaped marks or fingerprints applied more densely, thus covering larger areas of the vessel. Group Av 18; Group Av 19 (CPII 22 and 23)
 - B3) Systems of horizontal, vertical or diagonal bands that bear rounded or oval shaped marks or fingerprints, sometimes intersecting each other, creating rectangular, triangular or other more complex designs. Group Av 20; Group Av 21; Group Av 22; Group Av 23; Group Av 24 (CPII 24–27)
 - B4) Systems of horizontal bands that bear incisions, cut vertically or in an oblique manner, either dispersed freely on the surface or intersecting each other, creating complex designs. Group Av 25; Group Av 26 (CPII 28–30).

Shapes

Pithoi can be classified into two basic types: A. Closed pithoi (upper part of the body leaning inwards); and B. Open or bucket-shaped pithoi (upper part of the body opens outwards). These two pithoi shapes are found in almost all caves of the Late and Final Neolithic periods, with some differentiations in each type.

A. Closed pithoi: This is the commonest shape found at Alepotrypa.

Δ. 16115: Fragment of a semi-rounded rim not differentiated from the sherd's body; converging neck sides. Decoration consists of two simple (low relief) plastic bands circular in profile (decor. A1, Figure 7.1).

Δ. 7275: Fragment of a semi-rounded rim not differentiated from the sherd's body; converging neck sides. Decoration consists of one thin clay band that bears fingertip impressions very close to the rim (decor. B1, Figure 7.2).

Δ. 16108: Fragment of a semi-rounded, slightly everted rim. About 4 cm under the rim a light carination differentiates the neck from the body of the sherd. Converging body's sides. Decoration consists of two thin, diagonal clay bands that intersect with another horizontal band, triangular in profile (decor. A3, Figure 7.3)

B. Open (bucket-shaped) pithoi.

Δ 16138: Fragment of a semi-rounded vertical rim not differentiated from the sherd's body.

Vertical neck and shoulder sides. About 9 cm below the rim the profile converges. Decoration consists of one thin clay band that bears round and oval-shaped marks; another similar clay band about 10 cm further below (decor. B1, Figure 7.4). Between the plastic band and the rim, three holes.

Δ 5650: Fragment of a flat vertical rim not differentiated from the sherd's body. The sides of the body converge. Decoration consists of three consecutive horizontal plastic bands, circular in profile (decor. A2, Figure 7.5).

Not many bases of pithoi have been found at Alepotrypa Cave. All of them are generally flat. Below are listed three characteristic examples:

Δ 9419: Fragment of a flat base with slightly rounded perimeter. Decoration of the body consists of three horizontal consecutive clay bands that bear oval and circular marks (decor. B2, Figure 7.6).

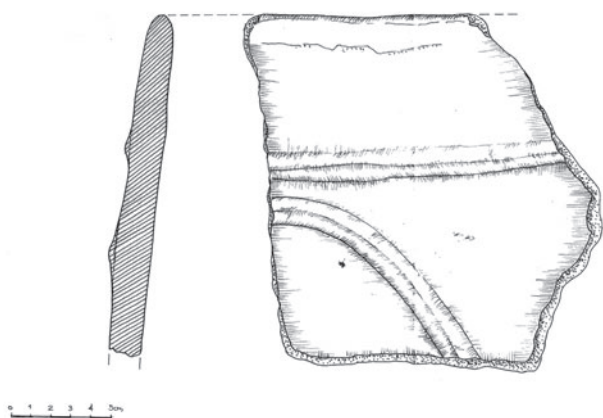


Figure 7.1. Closed pithos (shape A).

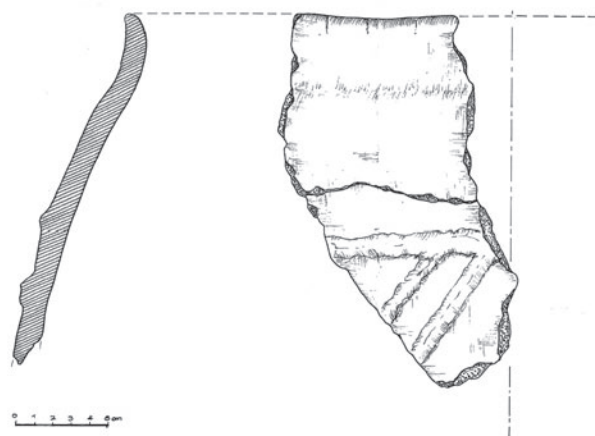


Figure 7.3. Closed pithos (shape A).

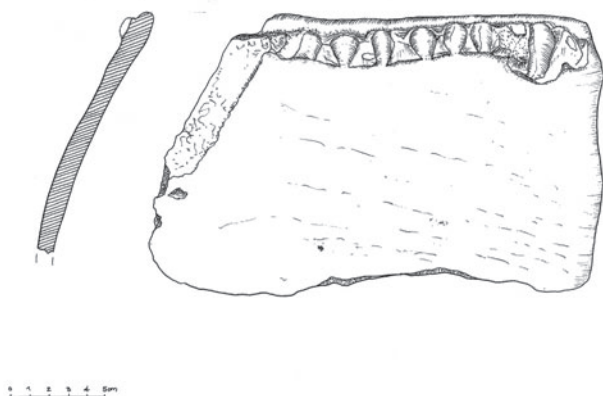


Figure 7.2. Closed pithos (shape A).

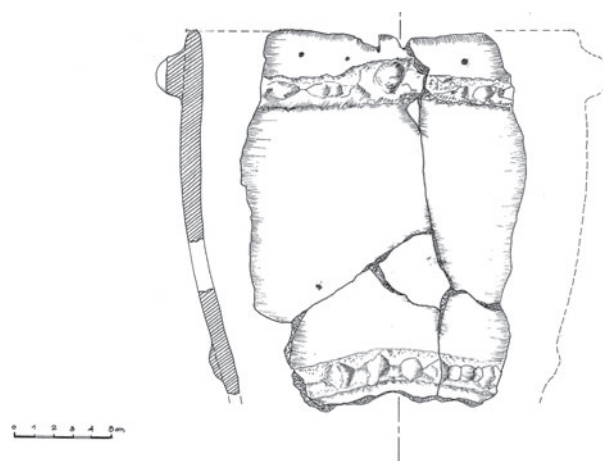


Figure 7.4. Open pithos (shape B).

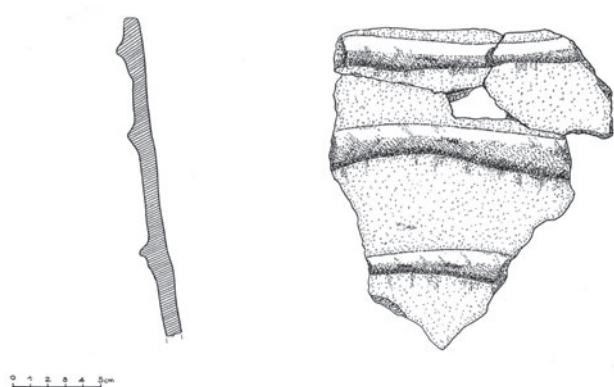


Figure 7.5. Open pithos (shape B).

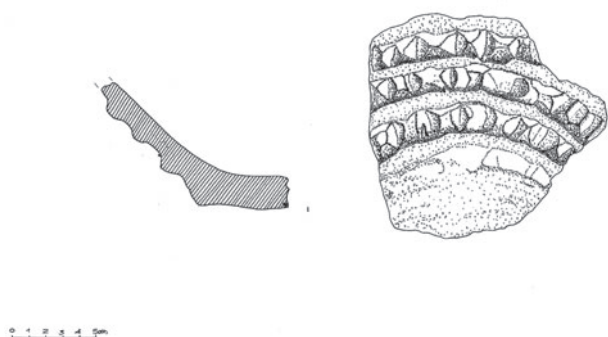


Figure 7.6. Pithos base.

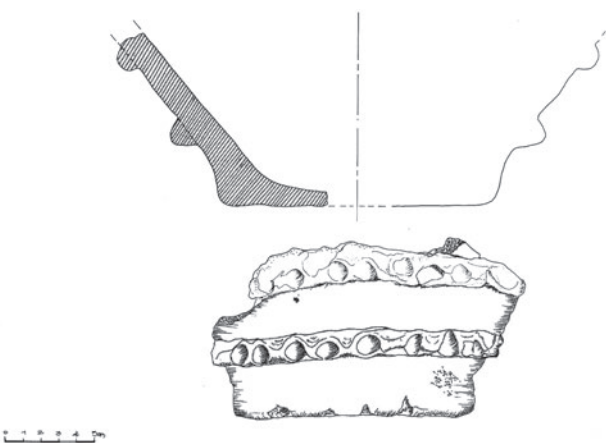


Figure 7.7. Pithos base.

- Δ 9422: Fragment of a flat base with rounded perimeter, slightly differentiated from the body with a smooth carination. Decoration of the body consists of two horizontal consecutive clay bands that bear circular marks (decor. B2, Figure 7.7).
- Δ 2177: Fragment of a flat base with slightly rounded perimeter slightly differentiated from the body with a smooth carination. Decoration of the body consists of two

horizontal consecutive simple clay bands with rounded profile (decor. B2, Figure 7.8).

Distribution of pithoi in Alepotrypa Cave

Pithos sherds with relief decoration were found in all areas of the cave. Their distribution is given in Table 7.1.

As is clear, the vast majority comes from Chamber B, making this the preferred area for the placement of the pithoi. This chamber has a quite even floor surface, suitable for many large vessels to be positioned, with easy access to the cave's entrance but also to the other half of the cave, Chamber D and the Chamber of the Lakes. According to Papathanassopoulos (2011, 52), pithoi were placed mainly at the sides of the cave, but the fact that 498 sherds were found in Trench B1, at the very centre of Chamber B, shows that such a hypothesis is not at all certain. In the north sector of Chamber B most pithoi sherds were found in B4 and B6. From other chambers a much smaller number was recovered. In Ossuary II (Θ 9, 10, and 11), an area where secondary burials were practised, 138 sherds were found. In contrast, in Ossuary I of Chamber A only one fragment of a pithos vessel was found.

Note on chronology

Based on the sequence that resulted from the radiocarbon analyses conducted on samples from the cave, it can be inferred that all pithoi sherds found in the north sector of Chamber B belong to the Final Neolithic (c. 4,500 BC–3,200 cal BC), since they come from depths that do not exceed 1.20 m. In Trench B1 though, apart from a considerable number of sherds that belong to the Final Neolithic, at least 70 sherds come from depths between 1.80 m and 2.80 m (Omades 48–82, according to the excavation reports), *i.e.*, levels that belong to the Late Neolithic (c. 5,500–4,500 cal BC), based on the same radiocarbon analyses. It is interesting to note that in general there are no stylistic or other differences between Late Neolithic and Final Neolithic sherds, if one compares the material from the north sector (Final Neolithic) with the Late Neolithic material from Trench B1.

Discussion

Taking into account the numbers of pithoi fragments found, but also the archaeological record of the cave as a whole, it is evident that a considerable number of people or perhaps groups of people were involved in the activities inside the cave. Pithoi are present throughout the use of the cave in the Final Neolithic period and its abandonment, but also during the Late Neolithic. The pithos material, along with other objects and activities practised, were found mainly in Chamber B, the cave's centre. They were not

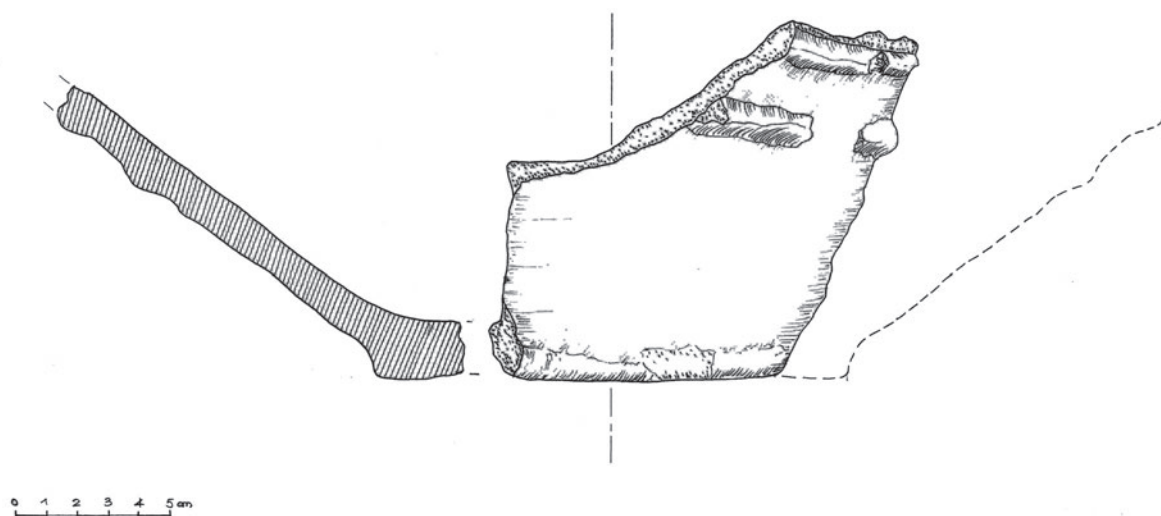


Figure 7.8. Pithos base.

Table 7.1. Distribution of pithos sherds in Alepotrypa Cave

Chamber	Excavation Unit	No. pithos sherds
A	Ossuary I	1
B	Trench B1	498
B	Trench B2	197
B	Trench B3	266
B	Trench B4	792
B	Trench B5	176
B	Trench B6	404
B	Trench B7	279
B	BKγA (Niche A)	52
D	Thesi 9 (Ossuary II)	77
D	Thesi 10 (Ossuary II)	45
D	Thesi 11 (Ossuary II)	16
D	Thesi 12	5
D	Thesi 13	4
D	Thesi 14	25
Chamber of Lakes	–	6

meant though to be hidden from the visitors' eyes in the 'darker' and more inaccessible part of the cave, although a small number of pithoi sherds were found in those areas (a matter which needs further consideration). If storage and the processes that it involves was the primary function of pithoi vessels, then Alepotrypa Cave offered to its inhabitants one important and perhaps sole, advantage, a more stable climate. Also, as a physical shelter, the cave did not require any extra construction effort, apart from the necessary arrangements of evening out its floors. On the other hand, artificial light is always needed in caves, provision has to be taken for external intruders (human or animal) and in the case of a natural disaster (e.g., small or larger-scale rock falls, a phenomenon very frequent in caves and not only as a result of an earthquake), there is grave danger for the cave's contents and its inhabitants. The question of why Alepotrypa Cave and other caves of the period were preferred to other sites for such activities and for such long periods remains unanswered.

Bibliography

- Blegen, C. W. and Rawson, M. (1966) *The Palace of Nestor at Pylos in Western Messenia I. The Buildings and Their Contents*. Princeton.
- Branigan, K. (1970) *The Tombs of the Messara: a Study of Funerary Architecture and Ritual in Southern Crete, 2800–1700 B.C.* London.
- Caskey, M. E. (1976) Notes on relief pithoi of the Tenian-Boiotian group. *American Journal of Archaeology* 80, 19–41.
- Coleman, J. E. (1977) Keos 1. *Kephala: A Late Neolithic Settlement and Cemetery*. Princeton.
- Cullen, T. and Keller, D. (1990) The Greek pithos through time: Multiple functions and diverse imagery. In W. D. Kingery (ed.) *The Changing Roles of Ceramics in Society: 26,000 B.P. to the Present*, 183–207. Westerville.
- Graham, J. W. (1962) *The Palaces of Crete*. Princeton.
- Immerwahr, S. A. (1971) *The Athenian Agora XIII. The Neolithic and Bronze Ages*. Princeton.
- Marinatos, S. (1931) Δύο πρώιμοι μινωϊκοί τάφοι εκ Βόρου Μεσαράς. *AD* 13, 137–170.
- Papathanassopoulos, G. A. (1966) *Neolithic Culture in Greece*. Athens.
- Papathanassopoulos, G. A. (2011) *Το Νεολιθικό Διρό. Σπήλαιο Αλεπότρυπα*. Athens.
- Phelps, W. W. (2004) *The Neolithic Pottery Sequence in Southern Greece*. (British Archaeological Report S1259). Oxford.
- Sampson, A. (1992) Late Neolithic remains at Tharrounia, Euboea. A model for the seasonal use of settlements and caves. *Annual of the British School at Athens* 87, 61–101.
- Sampson, A. (1997) *Το Σπήλαιο των Λιμνών στα Καστριά Καλαβρύτων. μία προϊστορική θέση στην ορεινή Πελοπόννησο*. (Εταιρεία Πελοποννησιακών Σπουδών 7). Athens.
- Wace, A. J. B., Holland, M., Hood, M. F. S., Woodhead, A. G. and Cook, J. M. (1953) Mycenae 1939–1952, *Annual of the British School at Athens* 48, 3–93.
- Warren, P. (1972) *Myrtos. An Early Bronze Age Settlement in Crete*. (British School at Athens Suppl. Vol. 7). London.
- Zachos, K. L. (1987) *Ayios Dhimitrios, a Prehistoric Settlement in the Southwestern Peloponnesos: The Neolithic and Early Helladic Periods*. Unpublished PhD dissertation, Boston University.

The Alepotrypa Cave pottery assemblage: a ceramic petrology approach

Areti Pentedeka

Introduction

Alepotrypa Cave is situated at the foot of Mount Saggias (the southern end of Mount Taygetos), by Diros Bay on the Messinian Gulf. Since excavation started in the 1970s, the long stratigraphical sequence revealed confirms human occupation from the early stages of the Neolithic period. The cave, as the numerous papers of this volume highlight, preserves a very rich repertoire of archaeological remains, which mainly date to the Late and Final Neolithic (hereafter referred to as LN and FN respectively). The ceramic assemblage unearthed is characterised by diversity, including monochrome and highly decorated wares and vessels of all shapes and sizes.

The present study aims to characterise the composition of the raw materials used and the properties of the resulting clay pastes, thus elucidating aspects of pottery production and the manufacturing technologies employed. Due to time and funding constraints, pottery sampling focused on two major spatial segments of the cave: Chamber B, situated at the entrance of the cave, and Chamber Z, approximately in the middle of the east–west axis of the cave. The pottery assemblage of the North Sector of Chamber B is characterised by the frequent occurrence of pithoi with elaborate relief decoration (see Valvis, this volume), and smaller (usually monochrome) vessels, among which open shapes, notably bowls, are common. Trench B1 in the same chamber produced rich finds, including both monochrome (with plain or burnished surfaces) and decorated painted wares (for Trench B1 see Katsipanou, this volume). Chamber Z seems to have hosted continuous activities of both fragmentation and deposition of artefacts, possibly bearing on ritual/mortuary practices. The majority of the decorated pottery found in

the cave, particularly the Matt-painted and Polychrome wares, is concentrated in this chamber (for Chamber Z, see Psimogiannou, this volume). Coarse-wares and monochrome wares are also present, but less frequently so compared to Chamber B finds (for Chamber B see Katsipanou, this volume). Finally, a few sherds from monochrome vessels were sampled from Θ 27, situated in the deepest interior of the cave in the Chamber of the Lake (for Θ 27 see Katsarou, this volume).

After detailed macroscopic examination, a total of 68 ceramic samples (AC1–AC68; Appendix 8.1) were chosen to represent variability in fabric (type, quantity and size of inclusions, hardness, surface and core colour), ware (surface treatment and/or decoration) and vessel form. Two raw material samples were also included in the sample set to facilitate origin attribution and check the suitability of sediments available in the immediate vicinity of the cave for manufacturing pottery (Table 8.1). Sample ACGS1 was taken from the clayey layer identified in Trench B1 at a depth of 4.60 m, while ACGS2 was extracted from the Γ1 core produced during the drillings conducted for the geotechnical study of the construction works for the new museum.

Methodology

The pottery sampling was very targeted, as the study of the Alepotrypa Cave stratigraphy and pottery assemblage is still ongoing. Sampling focused on Chamber B (Trench B1) and on Chamber Z, because these areas are at present the more thoroughly investigated, allowing for contextual study. The main research objective of this pilot study was to characterise local production by examining the commonest and most typical wares and shapes characterising the

Table 8.1. Summary table of the raw material samples from the vicinity of the Alepotrypa Cave

Sample	Location	Field description	Workability and firing behaviour	Colour
ACGS1	Interior of cave, Chamber B, Trench B1, clayey layer at 4.60 m depth	very fine clayey sediment	very good plasticity, no alterations during firing	raw: 2.5YR 3/4 dark reddish-brown 700°C: 10R 4/6 red; 2.5YR 4/6 red (core: 5YR 6/4 light reddish-brown)
ACGS2	Immediate exterior of cave, drilling Γ1 (conducted by A. Bressiakas in frame of new museum construction works), part of core from 0.80–0.90 m depth	brown sediment with limestone inclusions, deriving from limestone erosion	moderate plasticity, no alterations during firing	raw: 7.5YR 6/4 light brown 700°C: 5YR 7/4 pink

Alepotrypa Cave pottery assemblage. The 68 pottery samples selected are qualitatively representative of the wares more frequently found in Chambers B and Z, namely the various plain monochrome wares, the Black and Grey Burnished wares, and decorated wares such as Matt-painted, Polychrome, with relief/plastic decoration and Urfirnis (the latter is rather scarcely represented in the cave, but typical of the Middle Neolithic pottery of southern Greece).

Petrographic analysis was conducted for the study of both ceramic and raw material samples, using a LEICA DM 2500P polarising microscope. The microscopic descriptions follow the descriptive system and terminology proposed by Whitbread (1986; 1989; 1995). Comparative charts were used to estimate void and inclusion frequency, sorting, and roundness (Bullock *et al.* 1985, figs 24, 27, 31 respectively). Kemp's frequency groupings (Kemp 1985) are adopted for inclusion frequency characterisation (predominant >70%, dominant 50–70%, frequent 30–50%, few 5–15 %, very few 2–5%, rare 0.5–2%, very rare <0.5%).

The ceramic samples were also subjected to refiring tests using a Nabertherm N5/C20 furnace in controlled laboratory conditions at 1000°C: maximum temperature was achieved gradually over a period of approximately 1.5 hours and was kept stable for another hour; then the kiln was turned off and the samples were left to cool overnight. Controlled refiring facilitates the distinction of different clay compositions (or slip/paint, reflected in their colour) by eliminating any variation in clay colour caused by the ancient firing conditions (Whitbread 1995, 390–391; Daszkiewicz and Schneider 2001; all colour characterisations mentioned in the text follow the Munsell Soil-Color Chart 2009 edition).

The raw material samples were diluted with water and left to settle. Two briquettes were made from each sample: one was left raw, while the other was fired at 700°C, following a similar firing procedure as for the refiring tests; the fired briquettes were then thin-sectioned.

Geological setting

The Mani peninsula comprises a relatively autochthonous unit characterised by the geological formations of

the Ionian isopic zone (having undergone low-grade metamorphism; also known as the Plattenkalk unit), and the overthrust series of the Tripolis isopic zone (Papanikolaou 1984, 2009). The stratigraphical sequence is characterised by the following formations, starting from the oldest (Dimadis and Taktikos 1977; Exindavelonis and Taktikos 1979; Latsoudas 1980; Psonis 1981; Psonis and Latsoudas 1983; Skourtsos and Lekkas 2004). The basement of the metamorphosed Ionian zone consists of a phyllitic series of Permian (?) to Lower (?) Triassic age, characterised by shales, pelitic and graphite schists and phyllites, in alternation with chlorite-mica schists with quartz veins and quartzite intercalations. Upon this phyllitic series, the carbonate sedimentation develops from the Middle Triassic until the Upper Eocene, characterised by limestones, interrupted only by a silica-schist horizon of Upper Jurassic–Upper Cretaceous age. Slightly metamorphosed flysch of Upper Eocene–Oligocene date overlies the limestone formations, consisting of shales, phyllites and marly, pelitic or arenaceous schists. The base of the overthrust Tripolis zone has green-schist facies metamorphic beds of Permian–Lower Triassic age, consisting of alternations of phyllites, mica schists and quartzite intercalations. Upon this phyllitic series lies a Jurassic to Lower Cretaceous carbonate platform of medium to thick-bedded dolomitic limestones, dolomites and limestones. This carbonate platform in places (north-north-west of Areopolis, north-north-east of Gytheio; the Molaoi area) overlies a low-grade metamorphosed volcano-sedimentary sequence of Permian (?) age, named the Tyros beds. The lower part of the Tyros beds consists of shales with alternations of quartzitic sandstones and marly microcrystalline limestones, while the upper part consists of slightly metamorphosed basic to intermediate tuffs and tuffites. Pliocene sediments overlie unconformably their basement: they are attested in the form of marine or lagoonal formations, consisting of loose to cohesive marls, conglomerates and marly clays. The Pleistocene sediments are for the most part breccias and conglomerates, along with reddish sandy clays, while the Holocene consists of alluvial deposits (sandy clays, scree and talus cones).

Table 8.2. Petrographic descriptions of the ACGS1 and ACGS2 experimental briquettes (fired at 700°C)

Sample	c:f 10µm	Matrix	Description 700°C
ACGS1	15:85	moderately active PPL reddish-brown XPL dark orange-brown	Inclusions sa-sr, <0.4 mm mode 0.05–0.1 mm, well sorted <i>Frequent:</i> Quartz, monocrystalline <0.4 mm mode 0.05–0.1 mm, sa-sr <i>Few:</i> Alkali feldspar, mode 0.1 mm, sa-sr; Calcite, micritic <0.4 mm mode 0.2 mm, r; Tcfs (clay pellets) <0.8 mm mode 0.2–0.4 mm, PPL reddish-brown XPL dark red, clear to merging boundaries, r, equant shape, neutral to high optical density, discordant with the external matrix (no inclusions) <i>Very few:</i> Mica, mode 0.05 mm, white mica laths <i>Very rare:</i> Epidote?, mode 0.05 mm, sa.
ACGS2	30:70	active PPL brown XPL yellowish-brown	Inclusions a-sr, <3.6 mm mode 0.4–1.2 mm, poorly sorted <i>Predominant:</i> Calcite, crystalline, rarely micritic (possibly also some dolomite), <3.6 mm mode 0.4–1 mm, a-sa <i>Few:</i> Quartz-rich metamorphic rock fragments, <2.8 mm mode 0.4–0.8 mm, sa, quartz ± white mica ± opaque inclusions (red in PPL and XPL); Tcfs (clay pellets) mode 0.2–0.4 mm, PPL reddish-brown XPL reddish-brown to dark red, sharp to merging boundaries, r, equant to distorted shape, neutral to high optical density, discordant with the external matrix (no inclusions or sparse silt-sized calcite inclusions) <i>Very few:</i> Quartz, monocrystalline <1 mm mode 0.2 mm, sa-sr <i>Very rare:</i> Opaque inclusions, <0.3 mm mode 0.1 mm, sr-sa, iron oxides, black in PPL and XPL

Distinguishing fabric groups: the petrographic analysis results

Raw materials

Sample ACGS1 is a red-firing, rather fine-grained clayey sediment, characterised by quartz, alkali feldspar, micritic calcite and textural concentration features (hereafter abbreviated to Tcfs) in the form of clay pellets. ACGS2, however, fires light red and is coarse, containing crystalline calcite, a few quartz-rich metamorphic rock fragments and clay pellets (Table 8.2, CPII 31.a–b).

The fabric groups of the Alepotrypa Cave pottery assemblage

The 68 samples were attributed to different fabric groups after combining the petrographic analysis and the refiring tests results (Appendix 8.1). In total, seven fabric groups (FG) and two loners (LFG) have been identified within the examined sample set. The fabric groups are discussed below, first by summarising their compositional, textural and technological characteristics, and then followed by their systematic petrographic descriptions.

Fabric Group 1: Phyllite, quartz-rich metamorphic and shale (AC4, AC10, AC12–15, AC23, AC30, AC35–37, AC45–48, AC54, AC62–64)

Fabric Group 1 is a medium-coarse, red-firing fabric, characterised by low metamorphism (green-schist facies) rock fragment inclusions, such as phyllite, quartz-rich metamorphic rock fragments (mica schist for the most part) and shale, along with limestone fragments and clay pellets (CPII 31.c). This composition is compatible

with the geological formations of the wider area of Alepotrypa Cave (*e.g.* flysch). This fabric seems to represent a rather popular clay paste recipe within the sampled assemblage (28%) and is in use throughout the Neolithic for the manufacture of all vessel shapes (pithoi, various jar forms, fruitstands and bowls) and surface treatments (various monochrome vessels, plain with relief decoration, Matt-painted and both Urfinis samples, although they have some textural differences; for Urfinis ware, see discussion below on technology, raw materials).

PETROGRAPHIC DESCRIPTION

Microstructure: very few to few voids, predominantly mesovughs (rare macrovughs) and very few mesochannels (rare macrochannels); a very few voids have secondary micritic calcite coating and/or infilling (AC23, AC54); single to double-spaced porphyric related distribution; voids and inclusions are randomly oriented.

Groundmass: rather homogeneous, although the main inclusion types show variable frequency from sample to sample, inclusion concentrations are observed in a few samples (poor kneading), while colour differentiation is observed in AC47–48, AC54 (due to variable firing conditions); the micromass is optically active to moderately active, reddish-brown to brown in plane polarised light (PPL), orange-brown to reddish-brown to dark brown in crossed polarised light (XPL); a few samples are slightly active to inactive, brown to dark brown in PPL, very dark brown to very dark reddish-brown in XPL.

Inclusions: Inclusions are moderately well to poorly sorted, <2.6 mm mode 0.3–0.8 mm, subrounded (sr)-

subangular (sa); unimodal size distribution (bimodality related to grog temper is observed in AC4, AC10, AC23, AC54; possibly also in AC12–13, AC15, regarding major inclusion types; see also comment on FG4 below).

c:f:v_{60µm} c. 25:72:3 to 25:65:10 (end-members
30:65:5 to 20:75:5).

Common–frequent: PHYLLITE, <2.4 mm mode 0.3–0.8 mm, sr, dominantly with biotite, very few fragments with white mica, fragments frequently display crenulation foliation. *Common–few:* QUARTZ-RICH METAMORPHIC ROCK FRAGMENTS, <2 mm mode 0.3–0.6 mm, sr-sa. Fragments of i) fine grained mica schist, composed of quartz + mica (predominantly biotite, few white mica) ± chlorite ± opaque inclusions (black in PPL and XPL or very dark red in PPL and XPL; frequently fibrous), weakly to strongly foliated, few fragments also contain mica-rich/phyllite layers, and ii) medium coarse fragments, composed of quartz ± alkali feldspar (commonly sericitised) ± opaque inclusions (black in PPL and XPL or very dark red in PPL and XPL) ± mica. *Few–common:* SHALE, <2 mm mode 0.4–0.6 mm, sr-sa, fragments display strong lamination and frequently contain silt-sized quartz inclusions. *Few:* QUARTZ, mono- and polycrystalline <1.6 mm mode 0.1–0.3 mm, sa-rounded (r), grains are often strained displaying undulatory extinction. LIMESTONE, <2.2 mm mode 0.3–0.5 mm, sr. Fragments consist dominantly of micritic and/or sparitic calcite, few of crystalline or marly calcite (in AC13–15, AC23, AC37). *Very few:* ALKALI FELDSPAR, <0.6 mm mode 0.2 mm, sr-sa. MICA, mode 0.1–0.2 mm, predominantly biotite flakes and few white mica laths, rare sericite or chlorite aggregates. OPAQUE INCLUSIONS, <1 mm mode 0.05–0.2 mm, sr-sa, most probably Fe oxides, i) black in PPL and XPL, ii) rarely red in PPL and XPL. *Rare:* PLAGIOCLASE, mode 0.2 mm, sa. *Very rare:* ORGANIC MATTER, rather fibrous, 0.35 mm (AC30). *Textural Concentration Features:* Common to rare (only in AC10, AC23, AC54, AC45–46, AC48, AC63). 1) clay pellets (AC4, AC45–46, AC48, AC63): reddish-brown (PPL) very dark red (XPL), mode 0.2–0.6 mm, clear to merging boundaries, r, equant to distorted shape, neutral to high optical density, discordant to the external fabric (no inclusions or same range of inclusions as in the external matrix); 2) grog fragments (AC4, AC10, AC23, AC54): reddish-brown to dark brown (PPL) dark orange-brown (if moderately active) to very dark brown to very dark reddish-brown (if slightly active to inactive) (XPL), <2.6 mm mode 0.5–1 mm, clear to merging boundaries (few with a surrounding void), angular (a)-sr, prolate shape, neutral to high optical density, discordant to the external matrix (grog fragments contain quartz, quartz-rich metamorphic rock fragments, phyllite fragments, opaque inclusions or limestone fragments).

Fabric Group 2: Textural Concentration Features (Tcfs)/Clay pellets and grog (AC9, AC11, AC18–19, AC24, AC33–34, AC52, AC56–57, AC59, AC61, AC65, AC67–68)

Fabric Group 2 is a medium to medium-coarse, red-firing fabric, characterised by the presence of clay pellets and grog fragments, along with a few low metamorphic flysch-related rock fragments, which relate FG2 to FG1 and the flysch formations of the wider area of the cave (CPII 31d–e). This fabric (22% of the total sample) seems to be more widely used during the FN, only for monochrome vessels of all shapes and sizes (notably almost all sampled jars with lugs below the handles), and pithoi with relief decoration.

PETROGRAPHIC DESCRIPTION

Microstructure: few voids, dominantly meso- to macrochannels and few meso- to macrovughs; voids rarely have secondary micritic calcite infilling (AC52); single to double spaced porphyric related distribution; voids and inclusions are randomly oriented.

Groundmass: rather homogeneous, although inclusion concentrations are observed in all samples (poor kneading), while colour differentiation is observed in AC18–19, AC24, AC52, AC56, (due to variable firing conditions); the micromass is predominantly optically active to moderately active, reddish-brown in PPL, orange-red to orange-brown to reddish-brown in XPL; rarely slightly active to inactive, grey/brown to very dark red/black in PPL, very dark yellowish-brown to very dark red to black in XPL.

Inclusions: poorly to moderately well sorted, <4 mm mode 0.2–0.8 mm, a-sr, bimodal size distribution.

c:f:v_{125µm} c. 20:70:10 to 30:65:5.

Fine fraction <125 µm: *Predominant:* QUARTZ/ALKALI FELDSPAR, mode 0.05–0.1 mm, sr-sa. *Few:* Mica, mode 0.05–0.1 mm, dominantly biotite laths. *Very few:* OPAQUE INCLUSIONS, mode 0.05–0.1 mm, sr, most probably Fe oxides, black in PPL and XPL. *Very rare:* PLAGIOCLASE, mode 0.05 mm, sa-sr. EPIDOTE GROUP MINERALS, mode 0.05 mm, sa.

Coarse fraction: *Few–very few:* QUARTZ, monocrystalline <0.9 mm mode 0.2 mm, sa-sr; very few polycrystalline <1.2 mm mode 0.6 mm, sa. *Very few:* QUARTZ-RICH METAMORPHIC ROCK FRAGMENTS, <2.6 mm mode 0.3–0.6 mm, sa-sr, main constituent is quartz (commonly strained), in granoblastic texture, rarely with schistosity (AC9, AC24, AC33, AC59, AC65, AC68). CALCITE, <1.6 mm mode 0.3–0.8 mm, r-sa; marly micritic or crystalline limestone fragments (AC11, AC19, AC33–34). PHYLLITE, <1.6 mm mode 0.2–0.8 mm, sr, main constituent biotite in the larger fragments, white mica in the rest, frequently with crenulation foliation (AC11, AC33, AC59, AC65).

OPAQUE INCLUSIONS, <0.4 mm mode 0.15–0.2 mm, sr-sa, most probably Fe oxides black in PPL and XPL; 1.2 mm, r, very dark in PPL and black in XPL, iron nodule with silt sized quartz inclusions. *Very few-rare*: ALKALI FELDSPAR, <0.4 mm mode 0.2 mm, sa-sr, few sericitised. *Rare*: Plagioclase, mode 0.2 mm, sa-sr. Siltstone, <3.6 mm mode 0.4–0.8 mm, sr (AC65, AC68). *Very rare*: METASANDSTONE, 1.8 mm, sr-sa, consisting of quartz in a clay minerals matrix, undergoing incipient metamorphism (AC33). SANDSTONE, mode 0.4–0.8 mm, sr-sa, consisting of quartz and alkali feldspar in a clay minerals matrix (AC59). SHALE, mode 0.4–0.8 mm, sr-sa, fragments with strong lamination (AC59). *Textural Concentration Features (Tcfs)*: PREDOMINANT TO DOMINANT, 1) grog fragments: greyish-brown to dark brown to black (PPL) very dark orange brown to very dark red to black (XPL), <4 mm mode 0.2–0.8 mm, sharp to merging boundaries (frequently with a surrounding void), sa, equant to prolate shape, neutral to high optical density, discordant to the external matrix (quartz, mica, opaque inclusions, less often calcite and schist inclusions; in AC33 and AC59 possibly second generation grog; *i.e.*, grog tempered grog); 2) clay pellets (possibly dried clay incorporated from the clay base during clay preparation): orange-red (PPL) dark orange-red/orange-red (XPL), <2.2 mm mode 0.2–0.4 mm, clear boundaries (few with a surrounding void), r, equant/prolate to distorted shape, neutral optical density, discordant to the external fabric (same range of inclusions as in the external matrix, differs only in the b-fabric orientation); 3) clay pellets: reddish-brown (PPL) very dark red (XPL), <1.8 mm mode 0.2–0.4 mm, sharp to merging boundaries, r, equant to distorted shape, neutral to high optical density, discordant to the external fabric (without inclusions or with sparse quartz/alkali feldspar silt-sized inclusions).

Fabric Group 3: Calcite (AC1–3, AC5–7, AC20–21, AC32, AC51, AC58, AC60, AC66)

Fabric Group 3 is a coarse fabric that when refired turned reddish-brown, containing marly micritic and crystalline limestone fragments (CPII 31.f). This composition is very compatible with the widespread limestone formations in the immediate vicinity of Alepotrypa Cave, indeed the entire Mani peninsula. This fabric (19% of the total sample) is almost exclusively used during the FN for the manufacture of coarse-wares (more than half of the sampled pithoi with relief decoration, half of the sampled ‘cheese pots’, various jars) and less frequently of monochrome wares (bowls and jars).

PETROGRAPHIC DESCRIPTION

Microstructure: very few to few voids, meso- to macrovughs; single-spaced porphyric related distribution; voids and inclusions are rather randomly oriented.

Groundmass: homogeneous; the micromass is optically active to moderately active, reddish-brown in PPL, orange-brown to reddish-brown in XPL.

Inclusions: poorly sorted, <7 mm mode 0.4–1.2 mm, r-sa, unimodal size distribution.

c:f:v_{60µm} c. 30:65:5 to 35:60:5.

Predominant: CALCITE, <7 mm mode 0.4–1.2 mm, r-sa. Fragments are dominantly marly micrite lumps (with crystalline calcite and red iron oxide inclusions) and commonly crystalline calcite limestone fragments. *Rare*: QUARTZ, monocrystalline <0.25 mm mode 0.1 mm, sa. *Very rare*: OPAQUE INCLUSIONS, mode 0.1 mm, sr-sa. The inclusions are most probably Fe oxides, black in PPL and XPL.

Fabric Group 4: Fine quartz-rich metamorphic, phyllite and clay pellets (AC16–17, AC27, AC41–42, AC44)

Fabric Group 4 is a fine fabric that refired light red to red, containing clay pellets, quartz and a few flysch-related rock fragment inclusions (quartz-rich metamorphic rock fragments, phyllite, shale) (CPII 32.a). This composition, as well as textural similarities, connect FG4 to FG1, as its fine variant; the FG4 clay paste is based on a clay mix of a clay strongly resembling that of FG1 only finer (indicating either cleaning/levigating for FG4, or tempering for FG1), with a fine silty calcareous sediment strongly resembling both texturally and compositionally the one used for the white wash background of the Matt-painted samples in FG4. The use of FG4 (9% of the total sample) is attested only in LN decorated vessels (notably the Matt-painted collared jars of the white wash on orange clay base variety).

PETROGRAPHIC DESCRIPTION

Microstructure: very few to few voids, dominantly mesovughs and few macrovughs and macrochannels; single to double-spaced porphyric related distribution; in AC16 voids and inclusions show well developed preferred orientation at an angle to the vessel wall (vertical cut; indication of slab or flattened coil), while in AC44 voids and inclusions show well-developed preferred orientation following a concentric arrangement (indication of relic coil).

Groundmass: fairly homogeneous, although streaks of different colour and texture are frequently observed (see Tcfs description below; indication of clay mix); the micromass is optically active to moderately active, reddish-brown in PPL, orange-brown in XPL; slightly active, reddish-brown in PPL, dark orange-brown in XPL.

Inclusions: well to moderately well sorted, <1.6 mm mode 0.1–0.3 mm, sr-sa; unimodal size distribution.

c:f:v_{10µm} c. 10:85:5 to 15:80:5.

Common: QUARTZ, monocrystalline <0.6 mm mode 0.05–0.1 mm, sr-sa, grains are often strained displaying undulatory extinction; polycrystalline <1.5 mm mode 0.3 mm, sa-r, grains are often strained displaying ribbon texture. *Few-rare:* QUARTZ-RICH METAMORPHIC ROCK FRAGMENTS, <1 mm mode 0.2–0.4 mm, sr-sa, composed of quartz + opaque inclusions (frequently fibrous black or very dark red in both PPL and XPL). PHYLLITE, <1.6 mm mode 0.3 mm, sr, dominantly with biotite, very few fragments with white mica, fragments frequently display crenulation foliation. SHALE, <1 mm mode 0.2 mm, sr-sa, fragments display strong lamination and frequently contain silt-sized quartz inclusions. *Very few:* ALKALI FELDSPAR, mode 0.05–0.1 mm, sr-sa. OPAQUE INCLUSIONS, <0.2 mm mode 0.05 mm, sr-sa, most probably Fe oxides, black in PPL and XPL. Mica, mode 0.1–0.2 mm, predominantly biotite flakes and few white mica laths. *Very rare:* LIMESTONE, 0.6 mm, sr, micritic calcite fragment with reaction rim and some loss of birefringence (incipient vitrification; AC17). *Textural Concentration Features:* DOMINANT, 1) clay pellets: reddish-brown (PPL $\times$ 50) dark red (XPL $\times$ 50), <2 mm mode 0.3–0.6 mm, sharp to merging boundaries, r, equant to distorted shape (streaks), neutral to high optical density, discordant to the external fabric (quartz and rare mica inclusions up to fine sand grain size); 2) clay pellets: light brown (PPL $\times$ 50) dark grey (XPL $\times$ 50), <3 mm mode 0.5–1 mm, clear to merging boundaries, a, distorted shape (streaks), neutral optical density, discordant to the external matrix (dense quartz, alkali feldspar and mica inclusions up to coarse silt grain size).

Fabric Group 5: Fine quartz (AC25, AC28–29, AC39, AC49, AC50)

Fabric Group 5 is a fine fabric, of variable refiring colour from reddish-yellow to light red to red, containing quartz and alkali feldspar (CPII 32.b). The rare occurrence of low metamorphism, flysch-related rock fragment inclusions (quartz-rich metamorphic rock fragments, phyllite, shale) constitutes a possible link to FG4 and FG1, rendering probable a local origin for this otherwise non-diagnostic fabric. The use of FG5 (9% of the total sample) is attested only during the LN, almost exclusively for the manufacture of Grey burnished and Buff monochrome vessels of both open (bowl, fruitstand) and closed (collared jar) shapes.

PETROGRAPHIC DESCRIPTION

Microstructure: very few to few voids, predominantly mesovughs and rarely macrovughs; single to double spaced porphyric related distribution; voids and inclusions are randomly oriented.

Groundmass: homogeneous; the micromass is optically active, brown in PPL, orange-brown to yellowish-brown in XPL ($\times$ 25).

Inclusions: well sorted, <2 mm mode 0.05–0.1 mm, sr-sa. Size distribution is unimodal.

$$c:f:v_{10\mu m} \text{ c. } 7:90:3 \text{ to } 10:85:5.$$

Frequent: QUARTZ, monocrystalline <0.4 mm mode 0.05–0.1 mm, sr-sa, grains are often strained displaying undulatory extinction. ALKALI FELDSPAR, <0.2 mm mode 0.05–0.1 mm, sr-sa, sericitised. *Very few:* MICA, <0.4 mm mode 0.1–0.2 mm, predominantly white mica laths and aggregates. *Very few-rare:* OPAQUE INCLUSIONS, <0.6 mm mode 0.05 mm, sr-sa, most probably Fe oxides (few maybe also graphite?), black in PPL and XPL, frequently in fibrous form (Common in AC50). *Rare:* QUARTZ-RICH METAMORPHIC ROCK FRAGMENTS, mode 0.6–0.2 mm, sa-sr, composed of quartz + alkali feldspar or quartz + white mica + chlorite (AC28, AC29). *Very rare:* SANDSTONE, 2 mm, sr, consisting of quartz + mica + alkali feldspar in a clay minerals matrix (AC28). PHYLLITE, 0.6 mm, sr (AC39). *Textural Concentration Features:* FEW-RARE, Clay pellets: reddish-brown (PPL $\times$ 50) dark reddish-brown to very dark red (XPL $\times$ 50), <1.2 mm mode 0.2–0.4 mm, sharp to merging boundaries, r, equant to distorted shape (streaks), high optical density, discordant to the external fabric (without inclusions).

Fabric Group 6: Calcareous and clay pellets (AC26, AC38, AC40, AC43)

Fabric Group 6 is a fine fabric that refired pink to red, characterised by marly micritic limestone and clay pellets (CPII 32.c). This composition is not incompatible with a local origin, although it is rather non diagnostic. The use of FG6 (6% of the total sample) is attested only during the LN, mostly for the manufacture of decorated Matt-painted and Polychrome collared jars.

PETROGRAPHIC DESCRIPTION

Microstructure: very few to few voids, predominantly mesovughs and rarely macrovughs; double-spaced porphyric related distribution; voids and inclusions are randomly oriented.

Groundmass: homogeneous; the micromass is optically active, brown in PPL, orange-brown to yellowish-brown in XPL ($\times$ 25).

Inclusions: moderately well sorted, <2.6 mm mode 0.4–0.8 mm, r-sa, unimodal size distribution.

$$c:f:v_{10\mu m} \text{ c. } 10:85:5 \text{ to } 10:87:3.$$

Common: CALCITE, <2.6 mm mode 0.4–0.8 mm, r-sr, fragments are dominantly marly micrite lumps and few sparitic calcite limestone fragments. *Few:* QUARTZ, monocrystalline <0.5 mm mode 0.1 mm, sr-sa. *Very few:* ALKALI FELDSPAR, <0.5 mm mode 0.1 mm, sr-sa. *Very few-rare:* OPAQUE INCLUSIONS, mode 0.05 mm, sr-sa, most probably Fe oxides, black in PPL and XPL, also in fibrous form. MICA, mode 0.1 mm, predominantly white mica

laths. *Rare*: QUARTZ-RICH METAMORPHIC ROCK FRAGMENTS, <0.8 mm mode 0.3 mm, sa-sr, composed of quartz + white mica (AC43). *Textural Concentration Features*: COMMON, Clay pellets: dark reddish-brown (PPL ×50) dark red to very dark red (XPL ×50), <1.2 mm mode 0.2–0.6 mm, sharp to merging boundaries, r, equant to distorted shape (streaks), high optical density, discordant to the external matrix (without inclusions or with sparse silt-sized quartz and mica inclusions).

Fabric Group 7: Calcite and grog (AC8, AC22, AC53)

Fabric Group 7 is a medium-coarse, red-firing fabric, characterised by marly micritic limestone and Tcfs (grog and clay pellets). The grog fragments and the clay pellets are almost identical in texture and composition to those of FG2 (CPII 32.d); thus FG7 should be considered as local. This fabric appears mainly in FN coarse-wares, including two ‘cheese pots’ and a relief-decorated pithos.

PETROGRAPHIC DESCRIPTION

Microstructure: few voids, dominantly mesovughs, and few macrovughs and rarely macrochannels (AC22); close-to single-spaced porphyric related distribution; voids and inclusions are randomly oriented.

Groundmass: rather homogeneous, although inclusion concentrations and uneven distribution are observed in all samples (poor kneading); the micromass is optically active, reddish-brown in PPL, orange-brown to orange-red in XPL.

Inclusions: poorly sorted, <2.4 mm mode 0.4–0.8 mm, a-r, bimodal size distribution.

c:f:v_{125µm} c. 25:75:5.

Fine fraction <125µm: *Common*: QUARTZ, mode 0.1 mm, sr-sa. CALCITE, crystalline, mode 0.1 mm, a-sa. *Very few*: MICA, mode 0.1 mm, dominantly white mica laths. OPAQUE INCLUSIONS, mode 0.05–0.1 mm, sr, most probably Fe oxides, black in PPL and XPL. ALKALI FELDSPAR, mode 0.1 mm, sr-sa. *Rare*: PLAGIOCLASE, mode 0.1 mm, sa.

Coarse fraction: *Common*: CALCITE, <1.4 mm mode 0.3–0.6 mm, r-sa; limestone fragments of marly, micritic and crystalline calcite. *Few*: QUARTZ, monocrystalline <0.6 mm mode 0.15–0.3 mm, sr-sa; polycrystalline mode 0.2 mm, sa. *Very few*: PHYLLITE, <1.6 mm mode 0.4–0.7 mm, sr, dominantly with biotite, few fragments display crenulation foliation (absent in AC22). *Rare*: OPAQUE INCLUSIONS, mode 0.2 mm, sr-sa, most probably Fe oxides, black in PPL and XPL. *Very rare*: SHALE, 2.3 mm, sr-sa, with strong lamination. *Textural Concentration Features*: FREQUENT TO COMMON, 1) grog fragments: <2.4 mm mode 0.4–0.8 mm, very similar in texture and composition to the grog fragments identified in FG2; 2) clay pellets (possibly dried clay as that of the clay base): mode 0.2–0.6 mm, very similar to those of FG2.

Loner Fabric Group 1: Quartz-rich metamorphic, phyllite and altered igneous (AC31)

Loner Fabric Group 1 is a medium, red-firing fabric, very similar to FG1 in both composition and texture (CPII 32.e). The only differentiating feature is the occurrence of few to very few igneous fragments altered under green-schist facies metamorphic conditions (medium-grained fragments with relic ophitic texture, composed of albite + chlorite + epidote + fibrous opaque inclusions) and almost isotropic tuff fragments, along with rare chlorite. This composition indicates sediments deriving from the Tyros beds. Thus, AC31, deriving from a LN Grey burnished fruitstand, should be considered as imported to the Alepotrypa Cave assemblage, although it was probably produced within Laconia (for further discussion on this sample, see below on assigning origins).

Loner Fabric Group 2: Calcite and quartz-rich metamorphic (AC55)

Loner Fabric Group 2 is a coarse fabric, firing dark reddish-brown, that bears strong similarities to ACGS2 in both composition and texture, also containing very few flysch-related inclusions strongly reminiscent of those in FG1 (CPII 32.f). On these grounds, AC55, a LN/FN monochrome bowl, probably represents a local, yet not that frequently used, clay paste recipe.

The Alepotrypa Cave ceramic assemblage: production loci and technological choices

Assigning origin

The petrographic analysis of the 68 pottery samples selected to represent the variability observed within the Alepotrypa Cave assemblage produced seven fabric groups and two loner fabrics. The vast majority of these fabrics (92%) seem to have been locally produced (FG1–5, FG7, LFG2), as their composition is characterised by low grade metamorphic rock fragments and limestone, and is in total agreement with the major geological formations in the wider area of Diros. The compositional attributes of FG6 (6%) are not strongly indicative in terms of origin, but do not exclude local production either. Previous petrographic analysis, focusing on the Black Burnished pottery from the cave, reached very similar conclusions (Pentedeke, 2005), while chemical analysis of sixteen sherds showed that all samples from Alepotrypa Cave were compositionally very similar, indicating the exploitation of similar, presumably local, resources for pottery making (Ochsenkühn *et al.* 1999).

The main recipe for pottery making within the local pottery tradition seems to be represented by FG1: it entails the exploitation of sediments deriving from the low-grade metamorphic rocks and flysch formations of the relatively autochthonous Ionian zone as developed in the Mani peninsula. This recipe is in use throughout

the Neolithic period as attested in the cave, and includes vessels of all wares, shapes and sizes, be it a pithos or an Urfirnis jar (local Urfirnis production is also suggested for other Peloponnesian sites; see Cullen 1985, 228–236). Nevertheless, most of the other recipes identified appear to be rather period- and ware- or shape-specific: FG2 for FN monochrome vessels; FG3 for FN pithoi and coarse-wares, including half of the ‘cheese pot’ samples; FG4 for a specific LN Matt-painted variety; FG5 for LN Grey burnished and Buff monochrome wares; FG6 mostly for LN Matt-painted and Polychrome collared jars; and finally FG7 for coarse-wares, mainly FN ‘cheese pots’. All fabrics seem to be rather evenly distributed in both of the chamber assemblages examined (both B and Z).

Only one sample (the Grey burnished fruitstand AC31/LFG1) can be characterised as a definite import, bearing a composition that is incompatible with local geology. It points rather to a volcanic/pyroclastic and low grade metamorphic geological environment. As mentioned above, such formations characterise the Tyros beds, the nearest outcrops being north-north-west of Areopolis, north-north-east of Gytheio, and in the Molaoi area (north-north-east coast of the Laconian gulf). Similar fabrics have been reported in relation to a small group of Black Burnished pottery (including a four-legged rhyton; Pentedeka 2005), therefore the present find should not be considered as exceptional or isolated. Moreover, these vessels are not the only imports attested in the material culture of Alepotrypa; bracelets made of *Spondylus gaederopus* (see Theodoropoulou, this volume), silver jewellery and, mainly, obsidian (from Melos; see Riebe, this volume) reveal a wide exchange network and seafaring activity (Papathanassopoulos 1983; Karali 1998). The route for obsidian procurement is considered to follow the south coastline of the Peloponnese to Cape Maleas, and then continue to Melos via the Karavi islands (Papathanassopoulos 1996). Even though Neolithic habitation of the southern Peloponnese is not very well known, there are a few Neolithic sites on the coast of the Laconian Gulf (Shipley 1996) that might constitute a local network of relations and contacts, essential for the survival of each community, not only in material terms, but also for social and biological reproduction (Perlès and Vitelli 1999).

The making of pottery technology in Neolithic Diros

Raw material selection and clay paste preparation

As outlined above, most of the raw material sources exploited should be located fairly near the cave; a program of systematic raw material prospection is needed, though, to take this point further. Nevertheless, the analytical results indicate that clay mixing and tempering was applied for the preparation of specific clay pastes. Clay

mixing, in the form of distorted clay pellets of different composition and texture than that identified for the clay body, is attested for FG4 (CPII 33.a). Interestingly, the same compositional and textural attributes characterise the fine calcareous sediment used as a slip on the Matt-painted samples of this fabric (CPII 33.f). Tempering is suggested for FG2, as grog (crushed pottery) fragments constitute the main inclusion type of this fabric (also for FG7 and a few FG1 samples). Moreover, the uneven distribution of the larger inclusions commonly observed in FG1, FG2 and FG7 might also denote the addition of non-plastic inclusions followed by rather careless wedging. The rare examples of second generation grog identified (CPII 33.b) imply that grog tempering was a consistent, rather than improvisational, choice in this potting tradition, driven out of a specific set of beliefs (as in Rainbird 1999) or a practical need for raw material recycling (as in Arthur 2013; Wayesa 2011).

Forming techniques

Very little information is preserved within the analysed samples on the exact forming techniques applied. A partially retained concentric arrangement of inclusions, distorted clay pellets, and voids in AC44 is interpreted as a relic coil, possibly pressed to flatten it, judging from the overall oval, rather than cylindrical, inferred shape (CPII 33.c). The use of flattened coils, or slabs, is also indicated in the vertically sectioned AC16 by the well developed preferred orientation of inclusions and voids at an angle to the vessel wall (Whitbread 1986; see Pentedeka 2015, for further discussion of forming techniques in Thessalian Neolithic assemblages).

Surface treatment techniques

The different surface treatment techniques known were represented in very few of the sampled pieces taken for analysis. The originally brown or black paint of the Matt-painted and Polychrome decorated samples remained black after the refiring tests, indicating the use of a manganese or ferromanganese paint, while the Urfirnis decoration, of both red and black colour, refired red, thus confirming the application of the iron-reduction technique (see next section). Evidence under the microscope of the slips applied for the decoration of these wares is minimal; the Urfirnis iron-rich slip is barely measurable (0.01 mm thickness), displaying reddish brown (PPL)-dark red (XPL) colour (CPII 33.d). The very fine clay used for the Urfirnis slip was most probably the finer fraction obtained after levigation of the clay. In Matt-painted ware, black (manganese-rich) paint is applied directly on the buff-firing surface of the pot as a thin layer of 0.02–0.03 mm thickness and of dark reddish-brown (PPL)-very dark red colour (XPL) (CPII 33.e). Alternatively, it can be applied on a calcareous slip of light brown/grey (PPL)-dark grey (XPL) colour, of variable thickness (reaching 1.6 mm),

with quartz, feldspar and mica inclusions up to coarse silt size (CPII 33.f).

Firing conditions

Petrographic analysis can only give a very rough estimate of some of the factors affecting the firing conditions. However, when it is combined with refiring tests and macroscopic examination of the sherd core, an approximation of the prevailing firing atmosphere and temperature during ancient firing is feasible (Whitbread 1995, 394). Regarding the firing temperatures, the optical activity of the groundmass (active to moderately active) and the unaltered state of calcite and mica suggest one below 800°C for the majority of the samples analysed. Very few samples (of the Matt-painted ware for the most part, as well as the black Urfirnis sample) possess a slightly active to inactive groundmass (not accompanied by thermal decomposition effects on minerals), thus suggesting firing temperatures over 800°C. The majority of the vessels seem to have been fired in an oxidising atmosphere, although not always a very well controlled one; the existence of mixed atmospheres is implied by the variability in the colour on the sherd core and surfaces. A reducing atmosphere is associated primarily with the Black and Grey burnished wares. The identification of a grey core (in one third of the analysed samples) suggests insufficient oxidisation and/or incomplete carbon oxidisation, most probably due to the short duration of firing, or, alternatively, a short oxidisation episode at the end of a firing procedure otherwise characterised by a mixed/reducing firing atmosphere (especially demonstrable when the boundaries of the grey core are clear-cut). All the above observations point to open- or pit-firing conditions, not always that successfully controlled.

Black Urfirnis ware, like the analyzed sample AC45, is the only Neolithic ware which involves the iron-reduction technique for its manufacture. This technique requires advanced pyrotechnological knowledge, as it necessitates very good control of the firing conditions, perhaps even the use of some sort of structure that serves as a kiln. It requires first the creation and maintenance of high temperatures, and then the alternation of oxidising and reducing atmospheres in a three-stage firing (Vitelli 1997; for other applications of the technique see Letsch 1982; Jones 1986; Maniatis et al. 1993). The fact that its application is only very seldomly recognised within the Alepotrypa Cave assemblage may relate to a restricted, seemingly local, system of production. This matter cannot be further discussed with the present level of data.

Conclusions

The analysis of the Alepotrypa Cave ceramic assemblage identified seven fabric groups and two loner fabrics. Of these, FG1 seems to represent the main recipe for pottery

making within the local ceramic tradition, practised throughout the Neolithic for the production of most shapes and wares. Alongside this there existed other well-defined recipes which appear to be more ware- or shape-specific. The raw materials were probably used in a rather unrefined state, with tempering a rather popular practice, especially in the form of grog-tempering during the FN. The coiling technique was used for the fabrication of the vessels, while refined clays were used for the different decorative effects. Pots were fired in open- or pit-firing conditions, usually at temperatures below 800°C. The iron-reduction technique was known and practised only for the production of the black Urfirnis ware. At the present level of data, pottery circulation is attested only for Black and Grey Burnished pots, but not the elaborately decorated wares found in quantities in the cave.

The results of this pilot study indicate that the imported pottery was ware-specific (Black and Grey Burnished for the most part). The different fabric recipes are rather limited in number; most of them are evidently local to the cave and are characterised by striking compositional homogeneity and constancy in execution through time. All the above features could imply that some of the pottery analysed was involved in very specific production and consumption practices, ones highly resistant to change or even variations from the norm. The lack of variability might be in part a biased result because of the sampling strategy; nevertheless, on the present data Chamber Z seems to be characterised by ritualistic, rather than domestic, consumption. In contrast, Chamber B/Trench B shows a greater variability in its wares, vessel shapes and fabrics, indicating a variety of consumption practices (possibly including also a more 'domestic' use of material culture and cave space).

The integrated scientific analysis of selected Neolithic pottery samples sought to illuminate aspects of their manufacturing technology, along with the nature and provenance of their raw materials, in order to further discuss issues concerning the production, circulation and consumption of the pots from Alepotrypa Cave. Along with the other papers in this volume, it contributes to a better understanding not only of the character of the cave occupation but also of the ideas and practices of its inhabitants in the distant past. Future sampling and analysis of cave spaces not examined within the frame of this pilot study (*e.g.*, the Ossuaries), with material dating earlier than the LN, as well as less frequent types of pottery (*e.g.*, mottled pottery) will together further enhance our knowledge and illuminate connections that are so far but obscure or hypothetical.

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Bibliography

- Arthur, J. W. (2013) Transforming clay: Gamo caste, gender, and pottery of southwestern Ethiopia. *African Study Monographs Supplementary Issue* 47, 5–25.
- Bullock, P., Federoff, N., Jongerius, A., Stoops, G. and Tursina, T. (1985) *Handbook for Soil Thin Section Description*. Wolverhampton.
- Cullen, T. (1985) *A measure of interaction among Neolithic communities: design elements of Greek Urniferous pottery*. Unpublished PhD dissertation, Indiana University.
- Daszkiewicz, M. and Schneider, G. (2001) Klassifizierung von Keramik durch Nachbrennen von Scherben. *Zeitschrift für Schweizerische Archäologie und Kunstgeschichte* 58, 25–31.
- Dimadis, E. and Taktikos, S. (1977) *Geological Map of Greece 1:50.000 Gythion*. Athens.
- Exindavelonis, P. and Taktikos, S. (1979) *Geological Map of Greece 1:50.000 Molaoi*. Athens.
- Jones, R. E. (1986) *Greek and Cypriot Pottery. A Review of Scientific Studies*. (Fitch Laboratory Occasional Paper 1). Athens.
- Karali, L. (1998) Τα όστρεα και οι χρήσεις τους στο σπήλαιο Αλεπότρυπα Μάνης. In E. Κυπριου (ed.) *Άνθρωπος και Σπηλαιοπεριβάλλον. Α Πανελλήνιο Σπηλαιολογικό Συνέδριο, 26–29 Νοεμβρίου 1992: Πρακτικά*. (Publication of the *Archaiologikon Deltion* 68), 107–114. Athens.
- Kemp, R. A. (1985) *Soil Micromorphology and the Quaternary*. (Quaternary Research Association Technical Guide 2). Cambridge.
- Latsoudas, C. (1980) *Geological Map of Greece 1:50.000 Mavrovounion-Areopolis-Yerolimnion*. Athens.
- Letsch, J. W. H. (1982) *Neolitische und Chalkolitische Keramik Thessaliens: Material, Rohstoffe und Herstellungstechnik*. Unpublished PhD thesis, University of Cologne.
- Maniatis, Y., Aloupi, E. and Stalios, A. D. (1993) New evidence for the nature of the Attic Black Gloss. *Archaeometry* 35, 23–34.
- Ochsenkühn, K. M., Zouridakis, N., and Ochsenkühn-Petropulu, M. (1999) Examination of Greek Neolithic ceramic shards by epithermal neutron activation analysis. *Journal of Radioanalytical and Nuclear Chemistry*, 242, 803–806.
- Papanikolaou, D. J. (1984) The three metamorphic belts of the Hellenides: a review and a kinematic interpretation. In J. E. Dixon, and A. H. F. Robertson, (eds) *The Geological Evolution of the Eastern Mediterranean*, 551–562. (Geological Society of London Special Publication 17). London.
- Papanikolaou, D. (2009) Timing of tectonic emplacement of the ophiolites and terrane paleogeography in the Hellenides. *Lithos* 108, 262–280.
- Papathanassopoulos, G. A. (1983) Ο ναυτικός χαρακτήρας του Νεολιθικού Διρού. *Πρακτικά του Α΄ Τοπικού Συνεδρίου Λακωνικών Μελετών, Μολάοι*, 5–7/6/1982, 221–224. Athens.
- Papathanassopoulos, G. A. (1996) Habitation in caves. In G. A. Papathanassopoulos (ed.) *Neolithic Culture in Greece*, 39–40. Athens.
- Pentedeka, A. (2005). *Technological and provenance study of Black-burnished Neolithic pottery from Alepotrypa, Diros cave, Laconia: Final report of petrographic analysis*. Unpublished Fitch Laboratory Internal Report.
- Pentedeka, A. (2015). Technological and Provenance Study of the Visviki Magoula Ceramic Assemblage. In E. Alram-Stern and A. Dousougli-Zachos (eds.) *Die deutschen Ausgrabungen 1941 auf der Visviki-Magoula/Velestino. Die neolithischen Befunde und Funde. Beiträge zur ur- und frühgeschichtlichen Archäologie des Mittelmeer-Kulturrumes* 36, 222–297. Bonn.
- Perlès, C. and Vitelli, K. D. (1999) Craft specialization in the Neolithic of Greece. In P. Halstead (ed.) *Neolithic Society in Greece*, 96–107. (Sheffield Studies in Aegean Archaeology 2). Sheffield.
- Psonis, T. K. (1981) About the presence of Permian (?)–Lower Triassic beds as a basement of the Plattenkalk series in the Taygetos Mt. Description of a continuous section. *Annales Géologiques des Pays Helléniques* 30, 578–587.
- Psonis, T. K. and Latsoudas, C. (1983) *Geological Map of Greece 1:50.000 Xirokampion*. Athens.
- Rainbird, P. (1999) Entangled biographies: Western Pacific ceramics and the tombs of Pohnpei. *World Archaeology* 31, 214–224.
- Skourtsos, E. and Lekkas, S. (2004) Kosmas-Gythio unit: a metamorphic carbonate sequence overlying the Phyllites-quartzites unit in Southern Peloponnesus, Greece. *Bulletin of the Geological Society of Greece* 36, 1679–1687.
- Vitelli, K. D. (1997) Inferring firing procedures from sherds: early Greek kilns. In P. M. Rice and W. D. Kingery (eds) *The Prehistory and History of Ceramic Kilns*. (Ceramics and Civilization VII). Westerville.
- Wayesa, B. S. (2011) The technical style of Wallaga pottery making: An ethnoarchaeological study of Oromo potters in Southwest Highland Ethiopia. *African Archaeological Review* 28, 301–326.
- Whitbread, I. K. (1986) The characterization of argillaceous inclusions in ceramic thin sections. *Archaeometry* 28, 79–88.
- Whitbread, I. K. (1989) A proposal for the systematic description of thin sections. Towards the study of ancient ceramic technology. In Y. Maniatis (ed.) *Archaeometry: Proceedings of the 25th International Symposium*, 127–138. Amsterdam.
- Whitbread, I. K. (1995) *Greek Transport Amphorae. A Petrological and Archaeological Study*. (Fitch Laboratory Occasional Paper 4). Athens.

Appendix 8.1. Summary table of the typological attributes and the analytical results for the 68 Alepotrypa Cave pottery samples analysed

Sample	Date	Excavation context	Ware	Shape	Refiring colour	Coarseness	Optical activity
FG1: Phyllite, quartz-rich metamorphic and shale fabric (19/68)							
AC4	FN	Δ5724 Chamber B B/7/134 16.2.71 Δ14447	Relief decoration (simple)	pithos	2.5YR 3/4 dark reddish- brown	medium-coarse	active
AC10	FN (?)	Chamber B B/7/130 15.2.71	Monochrome red	bowl	2.5YR 3/4 dark reddish- brown	medium-coarse	active
AC12	LN	Chamber B B1 T0 805 9.7.11 Δ17279	Decorated matt-painted	collared jar	2.5YR 5/8 red	medium-coarse	active – moderately active
AC13	LN	Chamber B B1β-Γ2/499 7.7.94 3.38–3.58 m Δ17046	Decorated matt-painted	collared jar	2.5YR 5/8 red	coarse	active – moderately active
AC14	LN	Chamber B B/11/331 29.10.93 3.80–3.85 m Δ13143	Decorated matt-painted	collared jar	2.5YR 5/8 red	medium-coarse	moderately active
AC15	LN	Chamber B B/1E/253 15.9.88 3.28–3.40 m Δ16730	Decorated matt-painted	collared jar	2.5YR 5/8 red	medium-coarse	moderately – slightly active
AC23	LNII	Chamber B B/1/290 13.7.92 skeleton soil of female burial 1 Δ16615	Relief decoration (impressed)	pithos	2.5YR 4/6–4/8 red	medium-coarse	inactive (active end)
AC30	LN	Chamber B B/10/258 19.9.88 3.40–3.60 m ΔΔK73	Black Burnished	fruitstand	2.5YR 4/6–4/8 red	medium-coarse	active
AC35	LN	Chamber Z Z/22/267 27.2.95 ΔΔK78	Decorated matt-painted	collared jar	2.5YR 4/6–4/8 red	coarse	moderately – slightly active
AC36	LN	Chamber Z Z/22/434 27.6.94 ΔΔK84	Decorated matt-painted	collared jar	2.5YR 4/6–4/8 red	coarse	active – slightly active
AC37	LN	Chamber Z Z/22/558 3.2.95 ΔΔK298	Decorated matt-painted	collared jar	2.5YR 4/6–4/8 red	coarse	moderately active
AC45	LNI	Chamber Z Z/22/558 2.2.95 ΔΔK108	Decorated Urfirnis (black)	jar	2.5YR 4/6–4/8 red	medium-fine	slightly active – inactive
AC46	LNI	Chamber Z Z/22/558 3.2.95	Decorated Urfirnis (red)	jar	2.5YR 6/8 light red	medium-fine	active – moderately active

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Appendix 8.1. Summary table of the typological attributes and the analytical results for the 68 Alepotrypa Cave pottery samples analysed (Continued)

Sample	Date	Excavation context	Ware	Shape	Refiring colour	Coarseness	Optical activity
AC47	LNI	Chamber Z Z/22/558 2.2.95	Black Burnished	high necked collared jar	2.5YR 4/6–4/8 red	medium–coarse	active (inactive end)
AC48	LNI	Chamber Z Z/22/Surf. Coll. 19.1.03	Black Burnished (white decoration)	jar with small strap jandle	2.5YR 3/4 dark reddish– brown	medium–coarse	active (inactive ends)
AC54	LN/FN	Chamber Z Z/22/568 26.6.95 0.85–0.95 m, 0.81–0.90 m	Monochrome	bowl	2.5YR 4/6–4/8 red	medium	active – moderately active (inactive layers)
AC62	LN	Chamber Z/ Niche 27 Ø27 23.7.70	Monochrome	jar	2.5YR 4/6–4/8 red	coarse	active
AC63	LN	Chamber Z/ Niche 27 Ø27 23.7.70	Monochrome	collared jar	2.5YR 5/8 red	medium–coarse	active
AC64	FN	Chamber Z/ Niche 27 Ø27 23.7.70	Monochrome	jar	2.5YR 6/8 light red	coarse	moderately – slightly active
FG2: Tcfs/Clay pellets and grog fabric (15/68)							
AC9	FN	Δ9062 Chamber B/ Niche A B/Niche A/66 5.12.70 Δ13863	Relief decoration (cordon)	pithos (?)	2.5YR 4/6–4/8 red	medium–coarse	active – moderately active
AC11	FN (?)	Chamber B B/6/113 2.2.71 Δ4532	Monochrome red/brown	bowl	2.5YR 4/6–4/8 red	medium	active – moderately active
AC18	FN	Chamber B B/1/49 24.8.70 1.95–2.10 m Δ4547	Coarseware	jar (flattened lug beneath the handle)	2.5YR 4/6–4/8 red	medium–coarse	inactive (active end)
AC19	FN	Chamber B B/1/83 15.12.70 2.75–2.80 m Δ18723	Coarseware	jar (flattened lug beneath the handle)	2.5YR 4/6–4/8 red	medium	active (inactive end)
AC24	LNII?	Chamber B B/1/287 13.7.92 skeleton soil of female burial 1 Δ4026	Relief decoration (simple)	pithos	2.5YR 4/6–4/8 red	medium	inactive (active end)
AC33	FN	Chamber B B/1/29 19.8.70 1.30–1.35 m	Monochrome coarse	jar	2.5YR 4/6–4/8 red	coarse	active

Appendix 8.1. Summary table of the typological attributes and the analytical results for the 68 Alepotrypa Cave pottery samples analysed (Continued)

Sample	Date	Excavation context	Ware	Shape	Refiring colour	Coarseness	Optical activity
AC34	FN	Δ3601 Chamber B B/1/39 21.8.70 1.65–1.75 m	Monochrome coarse	jar with strap handle	2.5YR 4/6–4/8 red	medium–coarse	moderately active
AC52	LN/FN	Chamber Z Δ17571 Z/21/367 Surf. Coll. 30.10.93	Monochrome coarse	closed biconical vessel (lug below the handle)	2.5YR 4/6–4/8 red	medium	moderately – slightly active (active end)
AC56	LN/FN	Chamber Z Z/22/567 27.2.95 0.85–0.95 m, 0.81–0.90 m	Coarseware	jar (strap handle and lug below it)	2.5YR 4/6–4/8 red	medium	active (inactive end)
AC57	LN/FN	Chamber Z Δ17609 Z/22/342 27.10.93 1.09–1.19 m	Coarseware	jar (tubular handle)	2.5YR 4/6–4/8 red	medium	active
AC59	FN	Chamber Z/ Niche 31 Δ1333 ΛA1/215/7 7.7.82	Monochrome	collared jar	2.5YR 4/6–4/8 red	medium–coarse	active
AC61	LN/FN	Chamber Z/ Niche 27 Θ27δ 1970	Monochrome	bowl	2.5YR 4/6–4/8 red	medium–coarse	active – moderately active
AC65	LN/FN	Chamber Z/ Niche 27 Θ27δ 10.8.70	Monochrome	deep closed vessel	2.5YR 4/6–4/8 red	medium–coarse	active
AC67	LN	Chamber Z/ Niche 27 Θ27δ 10.8.70	Monochrome	deep closed vessel	2.5YR 4/6–4/8 red	medium	active
AC68	LN	Chamber Z/ Niche 27 Θ27δ 10.8.70	Monochrome	deep closed vessel	2.5YR 4/6–4/8 red	medium–coarse	inactive
FG3: Calcite fabric (13/68)							
AC1	FN	Δ990 Chamber Δ Locus 19 Chamber Δ Δ8693	Relief decoration (impressed)	pithos	2.5YR 4/4 reddish brown	coarse	active – moderately active
AC2	FN	Chamber B B/4/89 16.01.71 Δ8221	Relief decoration (impressed)	pithos	2.5YR 4/4 reddish–brown	coarse	active
AC3	FN	Chamber B B/3/106 28.1.71 Δ15615	Relief decoration (impressed)	pithos	2.5YR 4/4 reddish–brown	coarse	active
AC5	FN	Chamber B B/3/88 15.1.71	Coarseware	pithos (holes below the rim)	2.5YR 4/4 reddish–brown	coarse	active – moderately active

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Appendix 8.1. Summary table of the typological attributes and the analytical results for the 68 Alepotrypa Cave pottery samples analysed (Continued)

Sample	Date	Excavation context	Ware	Shape	Refiring colour	Coarseness	Optical activity
AC6	FN	Δ1207 Chamber B B/5/103 25.1.71	Relief decoration (impressed)	pithos (holes below the rim)	2.5YR 4/4 reddish-brown	coarse	active – moderately active
AC7	FN	Δ7750 Chamber B B/1a/16 12.8.70 Δ2247	Relief decoration (impressed)	pithos	2.5YR 4/4 reddish-brown	coarse	active
AC20	FN	Chamber B B/1/29 19.8.70 1.30–1.35 m Δ2061	Coarseware	‘cheese pot’	2.5YR 4/4 reddish-brown	coarse	active
AC21	LN (II?)	Chamber B B/1H/204 22.7.78 3.03–3.07 m Δ13537	Coarseware	‘cheese pot’	2.5YR 4/4 reddish-brown	coarse	moderately active
AC32	FN	Chamber B B/1/14 12.8.70 0.00–0.20 m Δ17541	Monochrome	bowl	2.5YR 4/4 reddish-brown	coarse	active – moderately active
AC51	FN	Chamber Z Z/21/367 Surf. Coll. 30.10.93	Relief decoration (impressed)	wide-mouthed jar (holes below the rim)	2.5YR 4/4 reddish-brown	coarse	active – moderately active
AC58	LN/FN	Chamber Z Z/22/407 25.11.93 0.97–0.99 m	Coarseware	jar (tubular handle)	2.5YR 4/4 reddish-brown	coarse	active
AC60	FN	Chamber Z/ Niche 31 Δ9723 ΔA1/215/10 8.7.80	Monochrome with firing clouds	collared jar	2.5YR 4/4 reddish-brown	coarse	active – moderately active
AC66	LN	Chamber Z/ Niche 27 Θ27δ 10.8.70	Monochrome	bowl,	2.5YR 4/4 reddish-brown	coarse	active
FG4: Fine quartz-rich, phyllite and clay pellets fabric (6/68)							
AC16	LN (II?)	Chamber B B/1/85 15.12.70 2.92–3.08 m Δ13132	Decorated matt-painted	collared jar	2.5YR 5/8 red	fine (–medium)	active – moderately active
AC17	LN (II?)	Chamber B B/1M/251 15.9.88 3.12–3.25 m Δ16828	Decorated matt-painted	collared jar	2.5YR 5/8 red	fine (–medium)	moderately active
AC27	LN	Chamber B B/1E/298 23.10.92 3.67–3.77 m	Buff monochrome (probably was decorated)	bowl	2.5YR 6/8 light red	fine	active

Appendix 8.1. Summary table of the typological attributes and the analytical results for the 68 Alepotrypa Cave pottery samples analysed (Continued)

Sample	Date	Excavation context	Ware	Shape	Refiring colour	Coarseness	Optical activity
AC41	LN	Chamber Z/ Niche 31 ΛA1/217.18 26.7.80	Decorated matt-painted	collared jar	2.5YR 6/8 light red	fine	moderately – slightly active
AC42	LN	Chamber Z Z/22/657	Decorated matt-painted	collared jar	2.5YR 6/8 light red	fine	moderately – slightly active
AC44	LN	Chamber Z Δ14932 AΔK221 Z/22/627	Decorated polychrome	collared jar	2.5YR 7/6 light red	fine	active – moderately active
FG5: Fine quartz fabric (6/68)							
AC25	LN	Δ1141 Chamber B B/1/85 16.12.70 2.92–3.08 m	Buff monochrome	bowl	5YR 7/6 reddish– yellow	fine	active
AC28	LN	Chamber B B/11/256 17.9.88 3.25–3.45 m	Buff monochrome	bowl	2.5YR 7/6 light red	fine	active
AC29	LN	Chamber B B/1/53 35.8.70 2.48–2.60 m	Grey Burnished	fruitstand	2.5YR 4/6–4/8 red	fine	active
AC39	LN	AΔK105 Chamber Z Z/22/621 T.167 18.6.96	Decorated matt-painted	collared jar	5YR 7/6 reddish– yellow	fine–medium	active
AC49	LNI	Chamber Z Z/22/565 10.2.95	Grey Burnished	collared jar	2.5YR 5/8 red	fine	active
AC50	LNI	Chamber Z Z/22/558 2.2.95	Grey Burnished	collared jar	5YR 7/6 reddish– yellow	fine	active
FG6: Calcareous and clay pellets fabric (4/68)							
AC26	LN	Δ17357 Chamber B B/1Γ/430 24.6.94 3.50–3.79 m	Buff monochrome	bowl	2.5YR 5/8 red	fine–medium	active
AC38	LN	Δ14963 AΔK21 Chamber Z Z/22/570 T.41 28.6.95	Decorated matt-painted	collared jar	5YR 7/6 reddish– yellow	fine	active
AC40	LN	Δ14963 Chamber Z Z/22/624 T.183 18.6.96	Decorated matt-painted	collared jar	5YR 7/6 reddish– yellow	fine	active
AC43	LN	Δ14909 Chamber Z Z/22/562 9.2.95	Decorated polychrome	collared jar	7.5YR 8/4 pink	fine	active

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Appendix 8.1. Summary table of the typological attributes and the analytical results for the 68 Alepotrypa Cave pottery samples analysed (Continued)

Sample	Date	Excavation context	Ware	Shape	Refiring colour	Coarseness	Optical activity
FG7: Calcite and grog fabric (3/68)							
AC8	FN	Δ1005 Chamber B B/1/28 19.8.70 Δ1949	Relief decoration (simple)	pithos	2.5YR 4/6–4/8 red	medium–coarse	active
AC22	FN	Chamber B B/6/119 9.9.71 1.68–1.83 m	Coarseware	‘cheese pot’	2.5YR 4/6–4/8 red	medium–coarse	active – moderately active
AC53	LN/FN	Chamber Z Z/22/574 0.41–0.63 m	Coarseware	‘cheese pot’	2.5YR 4/6–4/8 red	coarse	active
LFG1: Quartz-rich, phyllite and altered igneous loner fabric							
AC31	LN	Δ17039 Chamber B B/10/334 27.10.93 3.85–3.88 m	Grey Burnished	fruitstand	2.5YR 4/6–4/8 red	medium	moderately active
LFG2: Calcite and quartz-rich metamorphic loner fabric							
AC55	LN/FN	Chamber Z Z/22/567 27.2.95 0.85–0.95 m, 0.81–0.90 m	Monochrome	bowl	2.5YR 3/4 dark reddish– brown	coarse	active

The chipped stone industries of Alepotrypa Cave: a general presentation

Georgia Kourtessi-Philippakis

Introduction

Alepotrypa Cave, discovered in 1958 by the speleologists Ioannis and Anna Petrocheilos, is situated in the southern Mani peninsula in the Peloponnese; it lies in a narrow coastal area, between the heights of the mountain Taygetos and the current shoreline (Figure 9.1). The cave measures about 250 m in length, running on an east–west axis (see Figure 0.1). It consists of several Chambers arranged in a series (CPI 3), from the current entrance to the Chamber of the Lakes at the furthest end (Papathanassopoulos 1996). The principal excavation took place in Chamber B where the thickness of the sediments allowed Trench B1 to be excavated to more than 3 m of depth. In the same chamber, as well in Chambers A, D and Z, small scale excavations took place in different loci. The exploration of these loci was confined by the thickness of the sediment, generally only a few dozen cm in depth. Only in one case, locus B2, did it reach nearly 1 m in depth. These excavations were spread out in time: starting in 1970–1971, then again with campaigns between 1978–1981, 1988–1989 and 1993–1994, until 2002 (Papathanassopoulos 2011). As a result of the excavation methods employed, as with the majority of the other material groups, the chipped stone was collected selectively in the absence of recovery methods aided by sieving (Kourtessi-Philippakis 2014a).

The study of the chipped stone assemblage presented here takes into consideration the material recovered in all the excavation campaigns. It aims to enrich the corpus of lithic studies in Greece, in particular of central and southern Greece and the Late and Final Neolithic, through careful consideration and comparison (Demoule and Perlès 1993). I will present and discuss consecutively the quantitative aspects, the raw materials, the techniques

and the reduction sequences, the tool types and finally the chrono-stratigraphical and spatial distribution (Tixier *et al.* 1980; Binder *et al.* 1990). Comparisons will be attempted with available data coming exclusively from caves, so that the Alepotrypa results and observations are set forth against an appropriate and analogous backdrop, one that may enhance our knowledge on matters of the supply and distribution of raw materials, the technological systems of production during the Aegean Neolithic and maybe even the character of these cave occupations. The last is a question that for a long time has been a topic of archaeological discussion in the region.

The quantitative aspect

The excavations in Alepotrypa Cave have brought to light 868 lithic artefacts in total (Table 9.1). The majority of this assemblage ($n = 526$, 60.59%) comes from excavations in Chamber B, and especially in Trench B1 ($n = 324$) and neighbouring loci B2 ($n = 111$), B3 ($n = 17$), B4 ($n = 12$), B5 ($n = 21$), B6 ($n = 33$) and B7 ($n = 8$). A minor fraction ($n = 67$, 7.71%) comes from the excavation of the loci situated in Chambers A, D and Z, whilst finally a quite important portion ($n = 275$, 31.68%) comes from the sediment removed during the construction works inside the cave, following its discovery in the late 1950s. This last set of material, which contains nevertheless interesting artefacts, has been termed within the frame of this study as *unstratified*. Even if this material is of unknown provenience, it may be assigned in general terms to the later Neolithic, since most of the contexts in the cave date to the Middle, Late, or Final Neolithic. Also, there are some pieces in the site inventories from the first speleological explorations in the cave, but because their origin is even more doubtful, they are not included in this study.



Figure 9.1. Map of Greece with the sites mentioned in the text. 1: Alepotrypa Cave. 2: Kouveleiki Caves. 3: Limnes Cave. 4: Franchthi Cave. 5: Saliagos. 6: Zas Cave. 7: Ftelia. 8: Kitsos Cave. 9: Skotini Tharrounion Cave. 10: Sarakinos Cave. 11: Corycian Cave. 12: Theopetra Cave. 13: Dimitra. 14: Sitagroi. 15: Dikili Tash. (by Georgia Kourtessi-Philippakis)

Table 9.1. Quantitative distribution of the lithic artefacts in Alepotrypa Cave

Context	B1	B2	B3	B4	B5	B6	B7	A	D	Z	Unstr.	Total
No. of pieces	324	111	17	12	21	33	8	18	20	29	275	868
%	37.32	12.78	1.95	1.38	2.41	3.80	0.92	2.07	2.30	3.34	31.68	95.95

The number of artefacts found in Alepotrypa Cave is broadly comparable to that recovered from excavations in other caves from the geographical zone mentioned above, such as the Sarakinos Cave in Boeotia, where the Late and Final Neolithic levels provided a total of 649 pieces (Kourtessi-Philippakis *et al.* 2008) or Kitsos Cave in Southern Attica, where 696 pieces were collected (Perlès 1981a). Such quantities collected in caves are, however, significantly lower when compared to the numbers coming from open-air Cycladic sites, such as Saliagos (Evans and Renfrew 1968; 25,000 pieces) and Ftelia in Mykonos (Galanidou 2002) where 17,267 pieces were collected during the first 3 years of excavation. This discrepancy is probably due to the fact that we are dealing with two different site-types – caves on mainland Greece (coastal or near-shore) *versus* open-air sites in the Cyclades. The volume of excavated sediment could well account for this disparity, but the impact of varying excavation methods also should be taken into consideration. In Franchthi Cave in the Argolid, for example, where all the sediment was

sieved, the number of the retouched artefacts from only the Late and Final Neolithic levels increased to 3,000 pieces (Perlès 2004).

The raw materials

The most used raw material at Alepotrypa Cave is obsidian (91.70%), but we also find various other siliceous rocks (7.83%), grouped here under the term *flint* (Table 9.2). These last range in colour from light to dark beige, even brown, grey and black flint, as well as a strongly patinated white version (CPII 35). Obsidian is present everywhere in the cave and dominant throughout the whole Late/Final Neolithic sequence. The only exception to this pattern comes from Chamber A, in contexts assigned to the Early Neolithic, where obsidian is in a minority compared to the siliceous materials. It also is only in that chamber that the white patinated flint is to be found.

Concerning the origin of the raw materials, only the obsidian has been the subject of specific research (see

Table 9.2. Distribution of the lithic artefacts by raw materials

Context	B1	B2	B3	B4	B5	B6	B7	A	D	Z	Unstr.	Total	%
Obsidian	290	109	15	8	20	33	7	5	19	29	261	796	91.70
Various flint	26	2	–	1	1	–	–	8	1	–	4	43	4.95
Grey flint	8	–	2	3	–	–	1	1	–	–	10	25	2.88
White patinated	–	–	–	–	–	–	–	4	–	–	–	4	0.46
Total	324	111	17	12	21	33	8	18	20	29	275	868	99.99

Riebe, Chapter 11); it is well accepted that it comes from the island of Milos, as it is the case for all the Neolithic sites in Central and Southern Greece (Cann and Renfrew 1964; Renfrew *et al.* 1965; Renfrew 1973; Torrence 1986). Furthermore, it seems that the two known sources (Sta Nyhia and Demenegaki) supplied the inhabitants of the cave. As for the siliceous rocks, they could have a local origin, coming, for example, from the neighbouring mountain of the Taygetos, belonging to the Pindos ridge. Some of the above cited varieties also appear in the lithic assemblage of Cave G in the Apidima complex, situated just north of Alepotrypa Cave and assigned to the Upper Palaeolithic (pers. obs.).

The picture of Alepotrypa Cave in terms of the lithic raw materials is in harmony with that from other caves of central and southern Greece during the Late and Final Neolithic. As at Alepotrypa, obsidian from both sources on Melos was used extensively at the Kouveleiki caves in Lakonia, where it accounts for 95% of the chipped stone assemblage (Kontaxi *et al.* 1995, 2003).

In the Skotini Tharrounion cave, this same material again makes up more than 95% of the total, alongside flint, radiolarite, and quartzite as minority materials (Perlès 1993). In Sarakinos Cave obsidian is also predominant, at 94.60%, alongside materials such as radiolarite and other flints which account for only 5.39% (Kourtessi-Philippakis *et al.* 2008). At Kitsos Cave, the rate of the obsidian is even higher, at 97.55%, alongside flint and chalcedony (Perlès 1981a), whilst in the Cave of Zas (Zachos 1999) it achieves a remarkable 98%.

These data permit us to confirm the existence of a clearly defined supply network, where obsidian plays a leading role alongside some complementary non-volcanic siliceous materials (Perlès 1990). This system involves coastal or near-shore sites in a specific regional pattern, namely the eastern part of central and southern Greece, an area which extends to the southern extremity of the Peloponnese. It is worth noting that even in the Cave of Zas, situated so close to the primary sources of obsidian, secondary materials are present. However, at sites more distant from the coast, the obsidian proportion drops sharply to 53.8% and 37.20%, as evidenced by the study of the lithic industries of the Corycian Cave, located on the slopes of Mount Parnassus, close to Delphi (Perlès 1981b) and of Limnes Cave, in the northern Peloponnese, near Kalavryta (Karabatsoli 1997) respectively. And the more we progress towards the north, the lower the percentage of obsidian becomes. In the Neolithic levels

of Theopetra Cave, in Western Thessaly, radiolarite is the principal material, at a rate of 77.6%, whilst obsidian is represented only by 21 pieces, a mere 3.4% of the whole industry (Skourtoupoulou 2000). Finally, in the Plain of Drama, in Eastern Macedonia, the Late Neolithic levels of Dimitra and of Dikili Tash show an extremely low use of obsidian (0.26% and 0.36% respectively) while in the equivalent levels at Sitagroi obsidian is absent altogether (Kourtessi-Philippakis 2006, 2009). The nature of this paper does not permit any extensive discussion between these northern and southern Aegean disparities. It appears, however, that quite distinct, and complex, trade networks were operating during the Late and Final Neolithic in both regions (Kourtessi-Philippakis 2014b). The south was centred on the exploitation of Melian obsidian, imported into the continent. Strongly divergent, the north was oriented rather towards more local materials – in Eastern Macedonia chalcedony, in Central Macedonia quartz and in Western Macedonia a chocolate flint from the Pindos range – supplemented by various external contributions such as honey-coloured Balkan flint and obsidian from the Carpathian Mountains and/or the island of Milos. These differences between northern and southern Neolithic communities reflect complex natural and cultural interactions that deserve to be explored.

Technology and reduction sequences

The issue of the organisation of the reduction sequences and technical procedures will be considered in the following pages by categories of raw materials, beginning with Melian obsidian and continuing with local grey flint and other imported raw materials.

Obsidian

Blocks or nodules of obsidian either tested for their knapping quality or decorticated have not been found at Alepotrypa. This initial stage of the reduction sequence produces first-series flakes, as well as large ones characterised by an extended cortical surface on their dorsal face and a prominent bulb of percussion. In the Alepotrypa lithic assemblage, no first-series flakes have been found; and some of the large flakes with prominent bulbs lack cortex on their dorsal faces. Indeed, the presence of artefacts with cortex is small; only 32 pieces (3.68%) have been encountered. On these pieces, essentially blades, the cortex occupies a small surface-area (less than the a third of the dorsal face), and is located

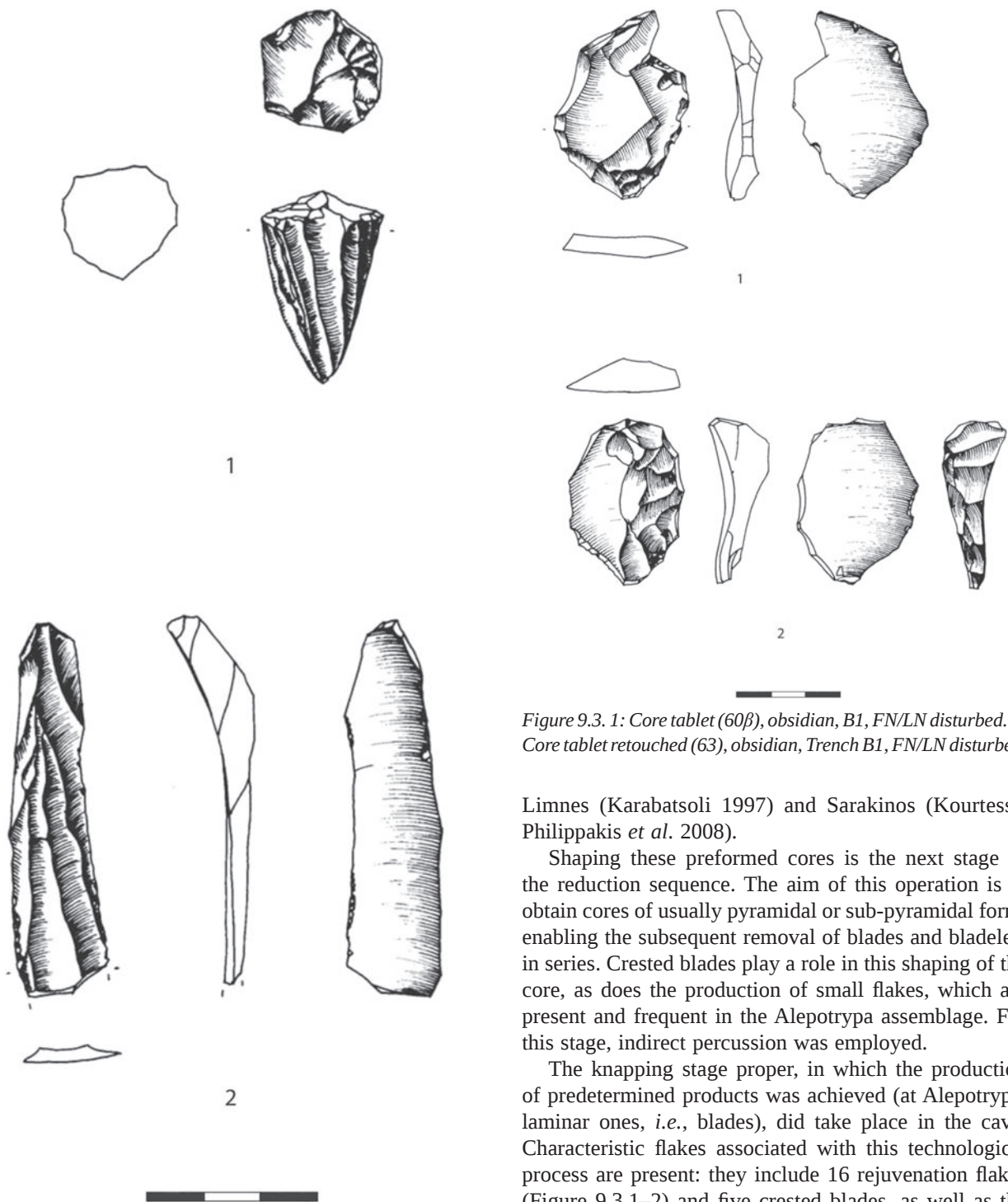


Figure 9.2. 1: Core (608), obsidian, unstratified. 2: Plunging blade broken at the proximal end (70), obsidian, Trench B1, LN.

near the edges. These observations indicate that the first stage of the reduction sequence did not take place in the cave; the cores were brought in preformed. This is a typical phenomenon in the Late and Final Neolithic levels in southern Greece. It has been observed in the chipped stone assemblages of most caves, such as Kitsos, Skotini Tharrounion, Franchthi, (Perlès 1981a, 1993, 2004),

Figure 9.3. 1: Core tablet (60β), obsidian, B1, FN/LN disturbed. 2: Core tablet retouched (63), obsidian, Trench B1, FN/LN disturbed.

Limnes (Karabatsoli 1997) and Sarakinos (Kourtessi-Philippakis *et al.* 2008).

Shaping these preformed cores is the next stage of the reduction sequence. The aim of this operation is to obtain cores of usually pyramidal or sub-pyramidal form, enabling the subsequent removal of blades and bladelets in series. Crested blades play a role in this shaping of the core, as does the production of small flakes, which are present and frequent in the Alepotrypa assemblage. For this stage, indirect percussion was employed.

The knapping stage proper, in which the production of predetermined products was achieved (at Alepotrypa, laminar ones, *i.e.*, blades), did take place in the cave. Characteristic flakes associated with this technological process are present: they include 16 rejuvenation flakes (Figure 9.3.1–2) and five crested blades, as well as the laminar products themselves. Unfortunately the crested blades are fragmented; two have been used as tool blanks. So, it is not possible to comment on the size of the cores before their removal. As for the end-products, obsidian knapping in Alepotrypa Cave expresses a clear preference for blades (68.49%), even if flakes coming from the first stages of the reduction sequence remain abundant (at 13.58%). The form of the tool blanks also confirms that these blades were intended to be shaped into tools. A similar situation is observed in the Late and

Final Neolithic assemblage of Sarakinos Cave (Kourtesi-Philippakis *et al.* 2008).

There is no doubt that the blades at Alepotrypa were systematically produced by pressure technique (Pelegri 1984, 1988): this is indicated by the strictly parallel arrises and edges, as well as by the types of butts (see below). However a significant number of blades show irregularities, such as irregular edges and arrises, as well as plunging distal tips, which may indicate the use of indirect percussion here as well (*cf.* also Perlès 2004).

The morphology and size of the flakes and blades allow us to conclude that the Late and Final Neolithic assemblage of Alepotrypa Cave was rather small physically. The extreme values for the lengths of entire obsidian flakes fall between 11 mm and 40 mm, with the width between 12 mm and 41 mm, and a thickness of 3–12 mm. The removal scars on the dorsal faces of the flakes indicate that they often were worked from opposite directions or perpendicular to the axis of the piece. The blades also are small. The longest entire blade found in Alepotrypa Cave measures 74 mm, with a width of 10 mm and a thickness of 3 mm.

The number of entire obsidian blades is relatively small (8.06%). In the Final Neolithic levels, their fragmentation pattern is characterised by the predominance of the medial segments (42.24%), followed by proximal segments (33.62%). Proximo-medial segments and distal segments are equal (12.06% for each group). In the Late Neolithic levels the above situation is reversed, with a slight preponderance of proximal fragments (40.62%) over medial segments (31.25%). This over-representation of the medial and proximal fragments could possibly mean that blades and bladelets fragments had been prepared elsewhere, may be outside, before being introduced to the cave.

As for the butts, in both the Final and Late Neolithic levels, faceted butts (41.37%) are dominant amongst the debitage products. Plain butts come in a far second (30.17%); then comes another group composed of the linear (14.65%) and dihedral (9.48%) forms, with punctiform butts (4.31%) bringing up the rear. It is worth noting that the types of butts associated with flakes and blades do not follow the same pattern. Plain butts are most abundant in the flake assemblage, followed in turn by the linear, punctiform, and dihedral, with the faceted type last. In the blade assemblage, by contrast, faceted butts form the majority, followed by plain, punctiform, dihedral, and finally linear butts. This patterning indicates that, unlike in flake production, the striking platforms of cores were well prepared before the removal of the laminar products. The bulbs of percussion are generally simple and prominent, especially on the flakes, although diffuse bulbs also are represented. Bulbar scars are very common on flakes and blades. The very frequent presence of lips pleads in favour of the use of the soft hammer technique. The overhangs are mostly fresh, although abraded ones also exist.

The end of the reduction sequence is represented by cores, splintered pieces, and debris. Cores are present in the Alepotrypa assemblage, but they are rare. A single exhausted pyramidal blade core with a prepared platform (Figure 9.2.1) has been found in an unstratified context, which can be assigned in general terms to the Late and Final levels of the cave. The presence of other pyramidal cores is attested through plunging blades which have removed the apex (Figure 9.2.2). One is complete ($5.40 \times 1.31 \times 0.39$ cm) with a direct proximal notch on the left edge. The other is broken at the proximal end, but retouched. The length of the entire plunging blade with the notch is more than that of the pyramidal core itself, so it is probable that cores, after the shaping out process, reached up to 7–8 cm.

The presence of additional cores in the Alepotrypa assemblage is indicated by a few tools that have a core fragment as a blank. One of them is a splintered piece (Figure 9.9.1). The splintering action very often causes the fragmentation of the core. This fragment is interesting also because it informs us about the presence of another type of core with two opposite platforms and blade removal scars from each end. If this second, opposed, platform is not subsidiary to the first one (*i.e.*, if it was not produced solely to maintain a core morphology effective for knapping; Tixier *et al.* 1980), then we could suggest that two different methods of blade production were used: the unipolar method, employing pyramidal cores with one striking platform, and a bipolar technique with two opposed platforms. But such a suggestion needs more complete laminar products, so that one may examine their degree of straightness or curvature, and thereby comprehend the type of core from which they derived. Obsidian debris and small flakes less than 1 cm across are both produced in the advanced stages of core reduction, in the working of splintered pieces and by the resharpener of certain tools: they represent 15.89% and 2% of the whole assemblage respectively. This number surely would be higher if sieving had been carried out systematically.

To sum up, the technological pattern of the obsidian assemblage from Alepotrypa Cave – namely the absence both of blocks tested for quality and of decorticated nodules, as well as the very few pieces with cortex on and finally the extreme rarity of cores, all argue that the phases of roughing out the blocks and nodules and the shaping of the cores did not take place in the cave. However, the presence of characteristic flakes like a few crested blades or rejuvenation flakes, at a rate of 2.76%, indicates that operations such as the renewal of the core platform or the preparation of the core for blade production did occur in the cave. The sections of the blades are accordingly in their overwhelming majority trapezoidal and triangular; very few are polygonal or irregular. The final stages of the reduction sequence are represented by small bladelets (the smallest complete bladelet is $24 \times 11 \times 2$ mm) and exhausted cores. The examination of the

above technological attributes indicates a high degree of standardisation of the products, and in particular of the blades. The form of these blades, when taken with the width of the blade scars observable on certain products and notably on the preserved pyramidal core, argues for intensive exploitation of obsidian at the site.

Siliceous rocks

The group of siliceous rocks in Alepotrypa Cave comprises 68 artefacts, or 7.83% of the total. The reduction sequence of the obsidian is not complete in the cave, and that of the siliceous rocks is even less so. The siliceous material can be classified in two groups.

The grey flint group

There are 25 pieces of grey flint (2.88% of the whole). The origin of this raw material – grey in colour, fine textured, translucent at the edges, but of mediocre quality – is probably to be sought in pebbles, as the distal fragment of a flake shows. Two globular and residual cores, one of them fragmented, flakes ($n = 10$) and debris ($n = 8$) all demonstrate that the grey flint was actually knapped *in situ*, in contrast to the obsidian and the following group of various flint-types. The complete core measures $3.70 \times 2.40 \times 2.50$ cm and one complete flake is 3.90 cm in length. The few complete flakes have a plain butt with a prominent bulb, indicating direct percussion. This small grey flint group is completed by three fragmentary blades (two medial segments and one distal) and by three tools, namely two splintered pieces on flakes and a bifacial point (Figure 9.14.1). No tools with gloss appear in this small group. As for their chrono-stratigraphical distribution, the two cores come from Final Neolithic levels. One of the splintered pieces was found in Chamber A, whose ceramic material is assigned to the Early Neolithic. As for their spatial distribution, the grey-flint artifacts have been found almost exclusively in Chamber B, and more precisely in Trench B1 ($n = 8$), as well in loci B3 ($n = 2$), B4 ($n = 3$) and B7 ($n = 1$). No grey flint was identified in Chambers D or Z.

Various flint-types group

This group contains 43 pieces (4.95% of the whole) of flint of different qualities and colours, varying from cream to light brown and chocolate to black. Many are tools, most of them bearing gloss due to agricultural activities (Perlès and Vaughan 1983); no production took place in the cave for these materials.

Typology and tool types

The tools (*i.e.*, blanks shaped further by an intentional retouch affecting either the edges or the distal and/or proximal ends, as well as *a posteriori* tools such as splintered pieces or pieces with gloss), number 255: a quarter of the whole assemblage (Kourtesi-Philippakis 2013). This rate is absolutely comparable with what is seen in the Late and Final Neolithic levels of other caves. In Sarakinos Cave, for example (Kourtesi-Philippakis *et al.* 2008), the number in the Late and Final Neolithic levels is 149 pieces (22.95%), and in Kitsos Cave (Perlès 1981a), the tools total 171, or 24.56% of the whole assemblage. In Skotini Tharrounion cave, however, the tools are slightly more numerous (30%; Perlès 1993).

In Alepotrypa Cave, the majority of tools are made of obsidian ($n = 200$, 88.88%). This is followed by the group of tools made in various flints ($n = 18.8\%$) and then in grey flint ($n = 3$, 1.33%). Four tools are white patinated (Table 9.3). Pieces with gloss are fashioned from these secondary raw materials and notably those comprising the ‘various flint’ category. These secondary raw materials also were used preferentially for bifacial points, with only one of the five made of obsidian. This contrasts with the projectile points, where the principal material is obsidian: only two are made of chocolate flint, ten of obsidian.

The tools of Alepotrypa Cave are distributed in well-defined typological groups and subgroups (Tables 9.4 and 5). Pieces with lateral retouch are dominant ($n = 54$, 24%). Four subgroups may be distinguished:

- blades with direct, sub-parallel, pressure retouch ($n = 10$; Figure 9.4.1–3).
- blades, mostly medial fragments, with direct, sub-parallel, semi-abrupt, retouch ($n = 9$), (Figure 9.4.5).
- blades with short direct or inverse, continuous or discontinuous, retouch ($n = 26$), Figure 9.4.4, 6; Figure 9.5.1–4).
- flakes with short direct retouch ($n = 9$).

This group is followed by those with notches ($n = 27$, 12%) using as their blanks more often blades ($n = 19$) than flakes ($n = 8$). The notches are generally small (0.3–0.5 cm across), fashioned by a fine retouch (Figure 9.6.2–6), but larger versions are detectable too (Figure 9.6.1), and some are seemingly of Clactonian type, though these may be the result of accidents. The majority of notches is associated with a non-retouched edge, though sometimes there is very

Table 9.3. Distribution of the raw materials used for tools by Chambers and loci

Context	B1	B2	B3	B4	B5	B6	B7	A	D	Z	Unstr.	Total	%
Obsidian	81	24	1	1	2	11	2	1	4	16	56	200	88.88
Various flint	5	–	–	1	2	1	–	5	1	–	3	18	8.00
Gray flint	1	–	–	1	–	–	–	1	–	–	–	3	1.33
White patinated flint	–	–	–	–	–	–	–	4	–	–	–	4	1.77
Total	87	24	1	3	4	12	2	11	5	16	59	225	99.98

Table 9.4. Distribution of the tool types by Chambers and loci

Context	B1	B2	B3	B4	B5	B6	B7	A	D	Z	Unstr.	Total	%
Retouched pieces	16	3	–	–	2	4	–	–	3	7	19	54	24.00
Notches	10	6	–	–	–	1	–	1	1	–	8	27	12.00
Denticulates	12	4	1	–	–	1	1	–	–	3	2	24	10.66
End-scrappers	15	5	–	–	–	3	1	–	–	2	11	37	16.44
Splintered pieces	10	4	–	3	–	1	–	1	–	2	9	30	13.33
Perforators	2	1	–	–	–	–	–	–	–	–	5	8	3.55
Burins	4	1	–	–	–	1	–	–	–	1	1	8	3.55
Truncations	7	–	–	–	–	–	–	–	–	1	1	9	4.00
Projectile points	8	–	–	–	–	1	–	–	–	–	3	12	5.33
Bifacial points	3	–	–	–	1	–	–	–	1	–	–	5	2.22
Pieces with gloss	–	–	–	–	2	–	–	5	–	–	–	7	3.11
White patinated	–	–	–	–	–	–	–	4	–	–	–	4	1.77
Total	87	24	1	3	5	12	2	11	5	16	59	225	

Table 9.5. Distribution of the tool types by blanks

Tool types	Flakes	Blades	Other	Total
Retouched pieces	10	44	–	54
Notches	8	19	–	27
Denticulates	3	21	–	24
End-scrappers	6	31	–	37
Splintered pieces	24	3	3	30
Perforators	2	6	–	8
Burins	2	6	–	8
Truncations	–	9	–	9
Projectile points	–	12	–	12
Bifacial points	5	–	–	5
Pieces with gloss	–	7	–	6
White patinated	–	4	–	4
Total	60	162	3	225
%	26.66	72	1.33	99.99

fine retouch present. Denticulates ($n = 24$, 10.66%) are also made on blades ($n = 21$), rather than flakes ($n = 3$; Figure 9.7.1–6). If we take into consideration the notched and denticulate pieces together ($n = 51$, 22.66%), then the next major group is the end-scrappers ($n = 37$, 16.44%). End-scrappers are generally simple, with the exception of one piece that is double. They are made on blades ($n = 30$), some of which are retouched ($n = 23$), and less frequently on flakes ($n = 6$; Figure 9.8.1–6). Splintered pieces ($n = 30$, 13.33%) form another important group, using as blanks mostly flakes or flake fragments (Figure 9.9.1–3).

Apart from these major tool-groups, we can distinguish other minor ones: such as truncations ($n = 9$, 4%) that are generally rectilinear (Figure 9.9.4–6), together with small perforators ($n = 8$, 3.55%) whose points are formed by convergent abrupt retouch (Figure 9.10.1–4), burins ($n = 8$, 3.55%; Figure 9.10.1–2), including a burin spall (Figure 9.10.3), projectile points ($n = 12$, 5.33%; Figures 9.12 and 13), bifacial points ($n = 5$, 2.22%), (Figure 9.14), pieces with gloss ($n = 7$, 3.11%), (Figure 9.15) and retouched pieces with white patina (1.77%; Figure 9.16).

The typological composition of the Alepotrypa assemblage presents similarities with that of Sarakinos Cave, in the sense that there exists at that site also a

dichotomy between a major and minor groups (Kourtessi-Philippakis *et al.* 2008), as defined above. Thus, pieces with lateral retouch ($n = 46$, 30.87%) also are the most numerous in Sarakinos, followed closely by splintered pieces ($n = 38$, 25.50%) and then end-scrappers (18, 12.08%). At Sarakinos, unlike Alepotrypa, notches and denticulates are fewer in number ($n = 10$, 6.71%). For the second, minor grouping of tools, the numbers are similar to that of Alepotrypa (*i.e.*, truncations ($n = 7$, 4.69%), burins ($n = 8$, 5.36%), perforators ($n = 7$, 4.69%), projectile points ($n = 7$, 4.69%), bifacial points ($n = 4$, 2.68%) and pieces with gloss ($n = 2$, 1.34%)). In the tool assemblage of Skotini Tharrounion Cave (Perlès 1993), retouched blades are dominant ($n = 70$), followed by end-scrappers ($n = 26$). On the other hand, as the final stage of the reduction sequence is absent at Skotini Tharrounion, there are only a few splintered pieces, quite different from Alepotrypa and Sarakinos. Projectile points, bifacial points, and pieces with gloss remain fairly constant in all three caves, but Skotini Tharrounion has fewer truncations, perforators, and pieces with gloss. Retouched blades ($n = 59$, 34.50%) and splintered pieces ($n = 30$, 17.54%) are dominant in Kitsos Cave (Perlès 1981a), and this site differs from the three other caves by the significant number of projectile points ($n = 39$, 22.80%) and perforators ($n = 13$, 7.60%) in the assemblage. End-scrappers number only 15 (8.82%), followed by truncations and burins. A typological pattern marked by the predominance of retouched blades/bladelets, followed by end-scrappers, has been observed at Limnes Cave (Karabatsoli 1997), where both projectile points and pieces with gloss are absent.

Finally, if we consider the assemblage as a whole, the tools of the various flint-types at these caves are more abundant than the tools in obsidian. There is thus a difference in the methods of managing these raw materials, and very probably also in the processes of acquisition of the flint. The introduction to caves of tools ready for use has been discussed for other sites (Perlès 1993; Kourtessi-Philippakis *et al.* 2008) and this also seems valid for Alepotrypa. The one

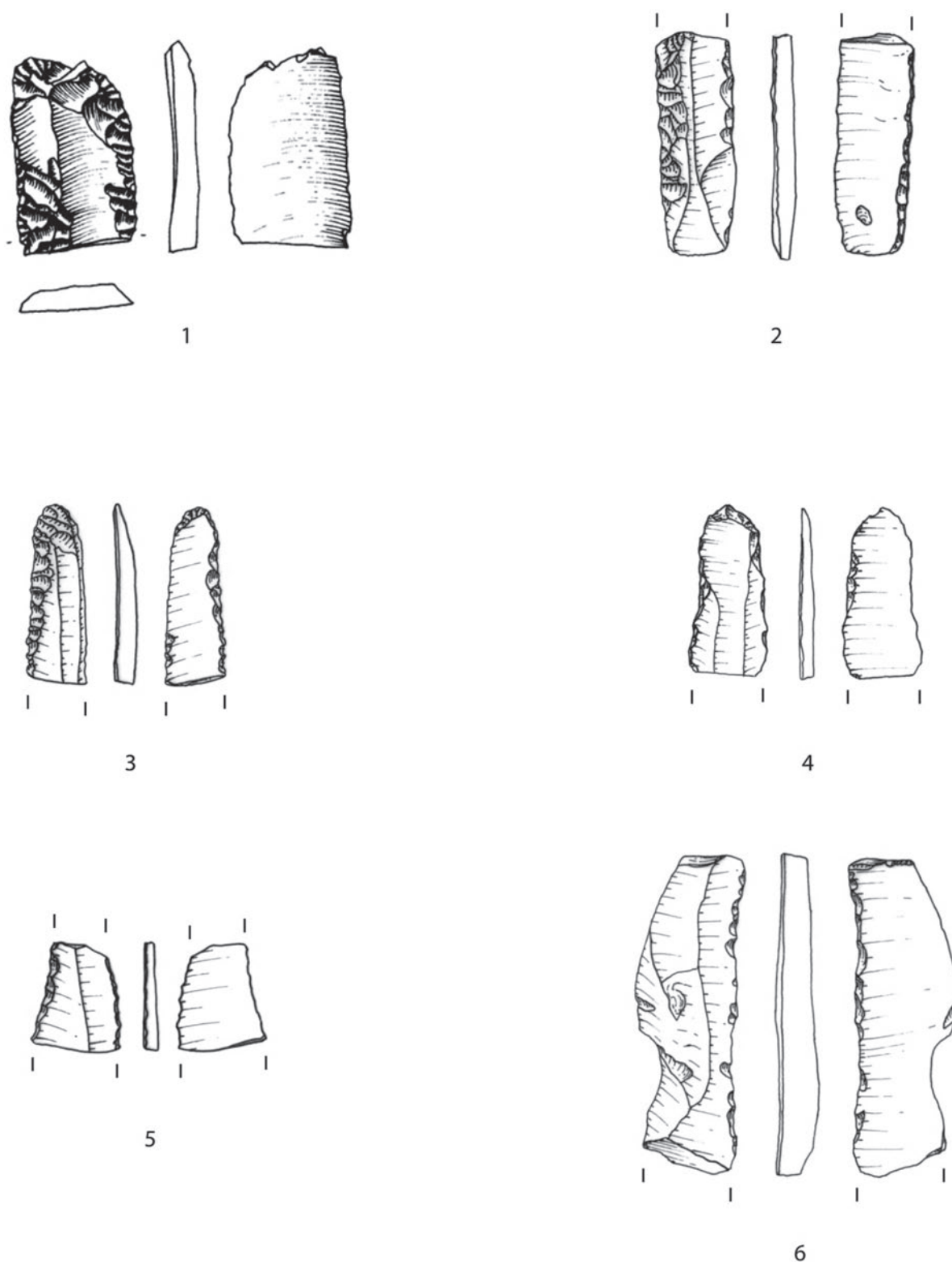


Figure 9.4. Retouched pieces. 1: Distal fragment of blade with subparallel retouch (310), obsidian, Trench B6, FN. 2: Blade broken at the distal end with subparallel retouch at the left edge (66δ), obsidian, Trench B1, LN. 3: Blade broken at the proximal end with subparallel bifacial retouch at the left edge, obsidian, Chamber Z, no date. 4: Distal fragment of blade with continuous retouch on both edges (356), obsidian, Chamber D, FN. 5: Medial fragment of retouched blade (354), Chamber D, FN. 6: Retouched blade broken at the proximal end (17642), obsidian, Chamber Z, no date.

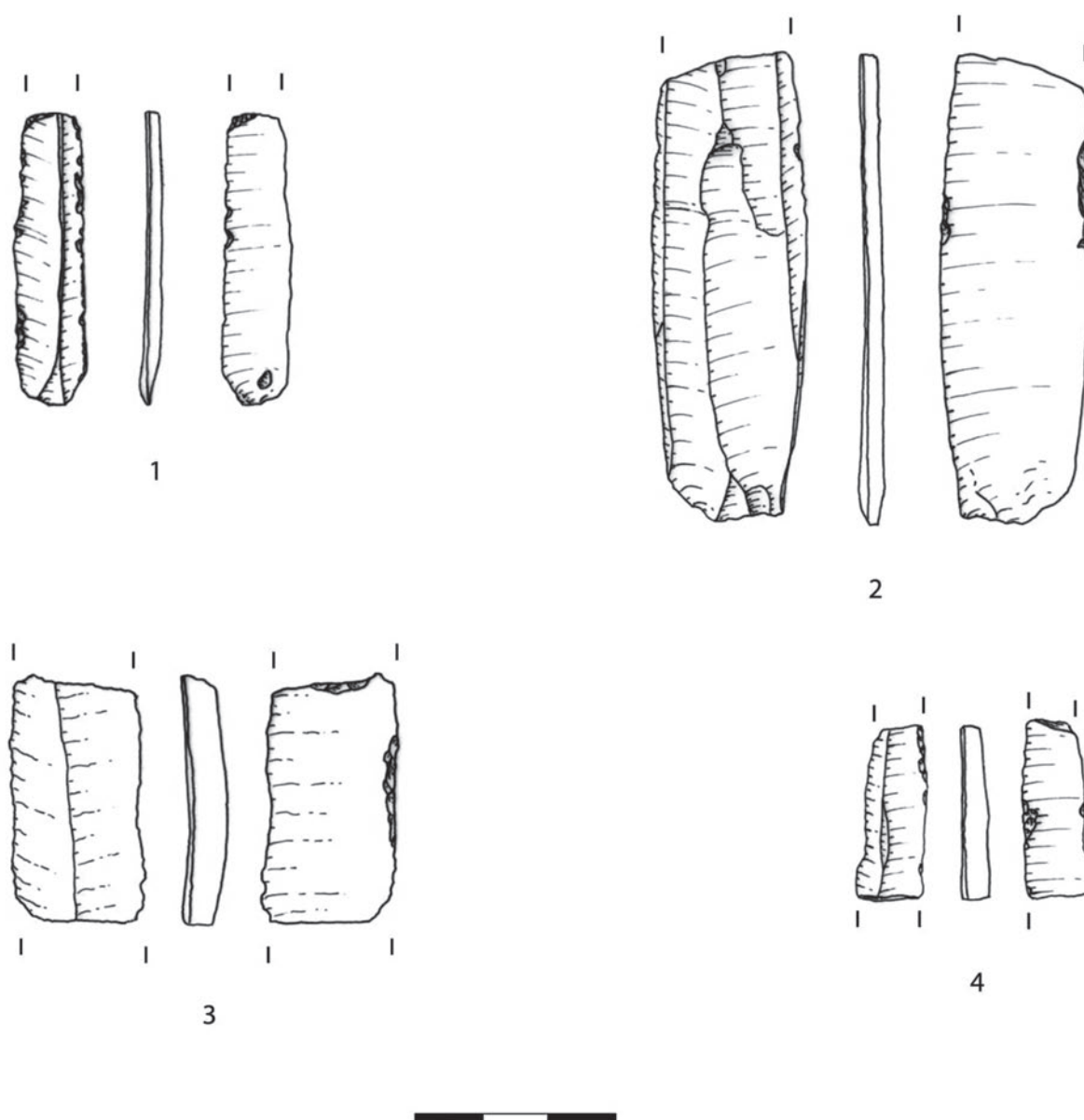


Figure 9.5. Retouched pieces. 1: Blade broken at the distal end with use retouch on both edges (no ref.), obsidian, Chamber Z, no date. 2: Blade broken at the distal end with inverse retouch (302a), obsidian, Trench B6, FN. 3: Medial fragment of blade with inverse retouch (17643), obsidian, Chamber Z, no date. 4: Medial fragment of blade with inverse retouch (no ref.), obsidian, Chamber Z, no date.

exception is the grey flint group, which was knapped locally (see above).

Of the several types of blanks at Alepotrypa, the overwhelming majority are blades. Of the tool assemblage as a whole ($n = 225$), blades used as blanks ($n = 162$) account for 72% of this grouping, the remainder are flakes ($n = 60$, 26.66%), residual cores, or indeterminate products ($n = 3$, 1.33%). But if the group of splintered pieces, mainly manufactured on flakes, is removed, the rate for the blades exceeds 80%. The fact that splintered pieces are *a posteriori* tools reinforces the observation on the conscious use of blades as blanks for formal tools.

The size of the blades used as blanks for the tools is larger than that of blades without retouch. Nothing with a width under 9 mm was used as a tool-blank; generally their width is between 11 and 18 mm with medial fragments predominant.

Chrono-stratigraphical distribution

Any attempt to elucidate chrono-stratigraphical variations within the Late and Final Neolithic levels of Alepotrypa Cave is fraught with risk, as only a small part of the lithic material can be taken into account here. This is due to the fact that in Trench B1 a considerable number of artefacts

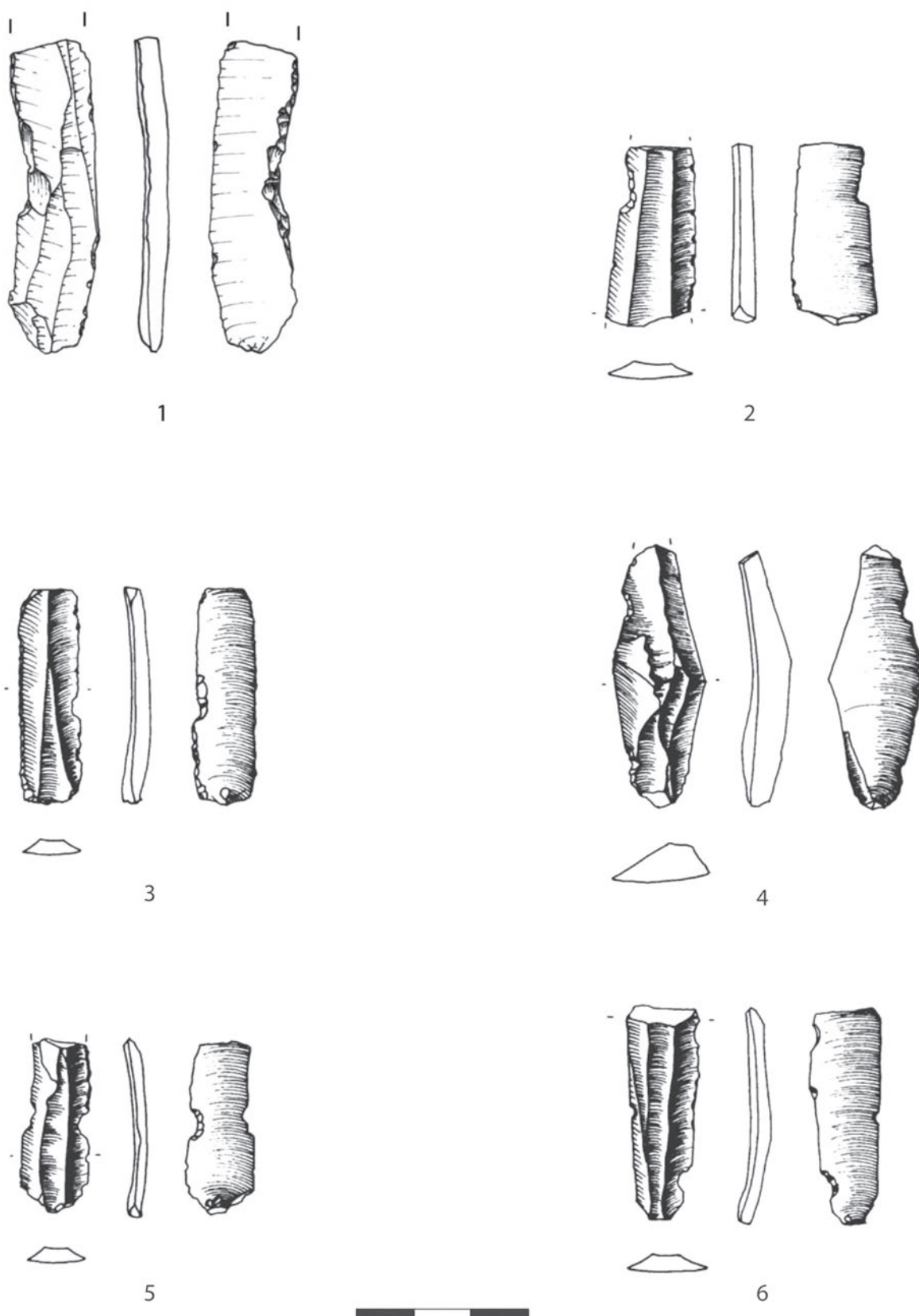


Figure 9.6. Notches. 1: Large inverse notch on blade broken at the distal end (76 α), obsidian, Chamber A, EN. 2: Direct notch on the left edge of a medial fragment of blade (689 β), obsidian, unstratified. 3: Inverse notch associated to a continuous retouch at the right edge of a blade broken at the distal end (283 α), obsidian, Trench B2, FN. 4: Direct notch at the left edge of a blade broken at the distal end (81), obsidian, Trench B1, LN. 5: Inverse notch at the right edge of a proximal fragment of blade associated to another opposite notch, obsidian, Trench B1, LN. 6: Inverse distal notch at the right edge of a blade (352 α), obsidian, Chamber D, FN.

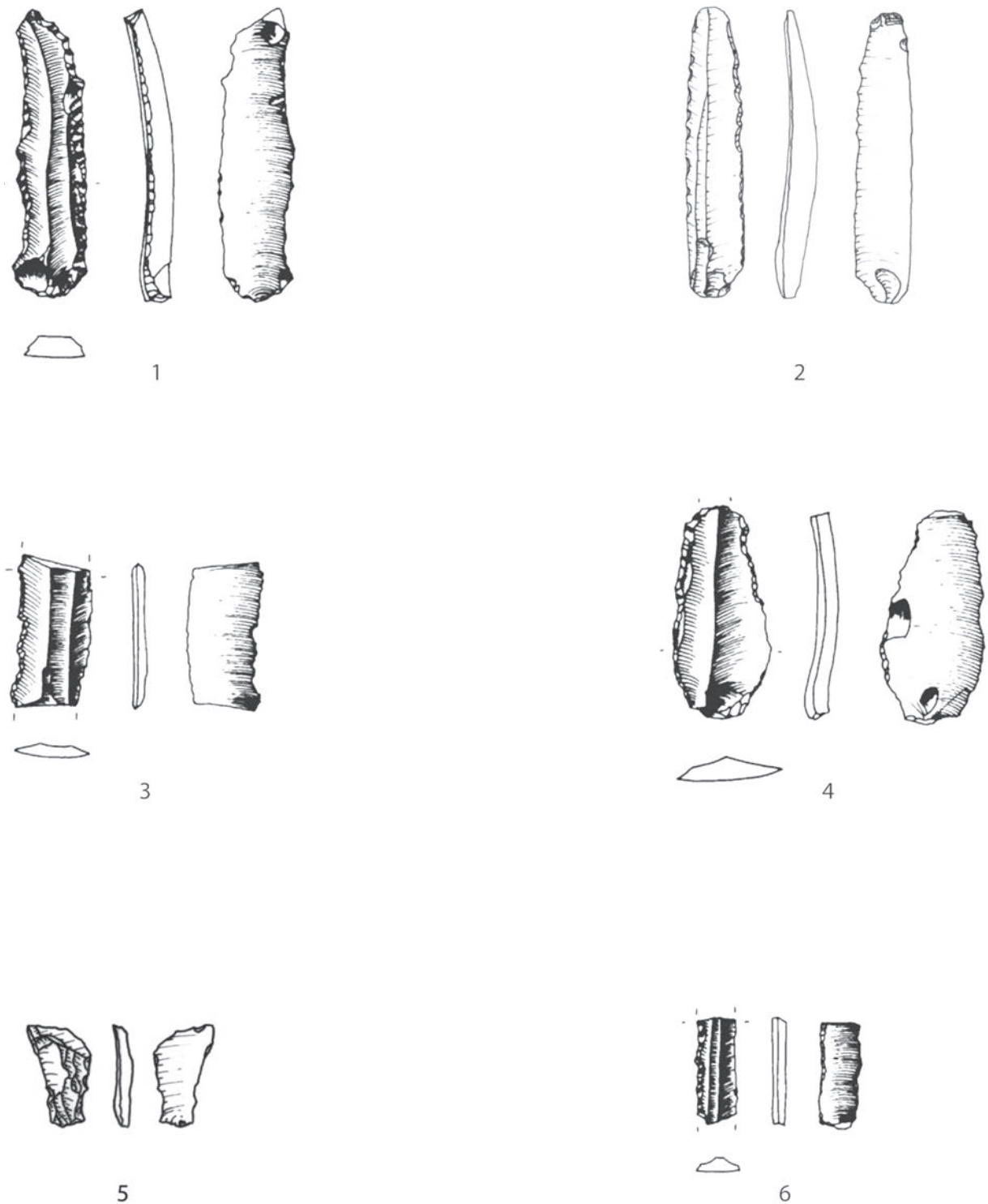


Figure 9.7. Denticulates. 1: Direct denticulation on the left edge of a blade associated to semi-abrupt retouch on the opposite edge (92a), obsidian, Trench B1, FN/LN disturbed. 2: Denticulated entire blade (no ref.), obsidian, Chamber Z, no date. 3: Medial fragment of blade with denticulation at the left edge (163c), obsidian, Trench B1, FN. 4: Blade broken at the distal end with alternate denticulation (66γ), obsidian, Trench B1, LN. 5: Entire blade denticulated at the right edge (no ref.), obsidian, Chamber Z, no date. 6: Medial fragment of bladelet with alternate retouch (180ε), Trench B1, FN.

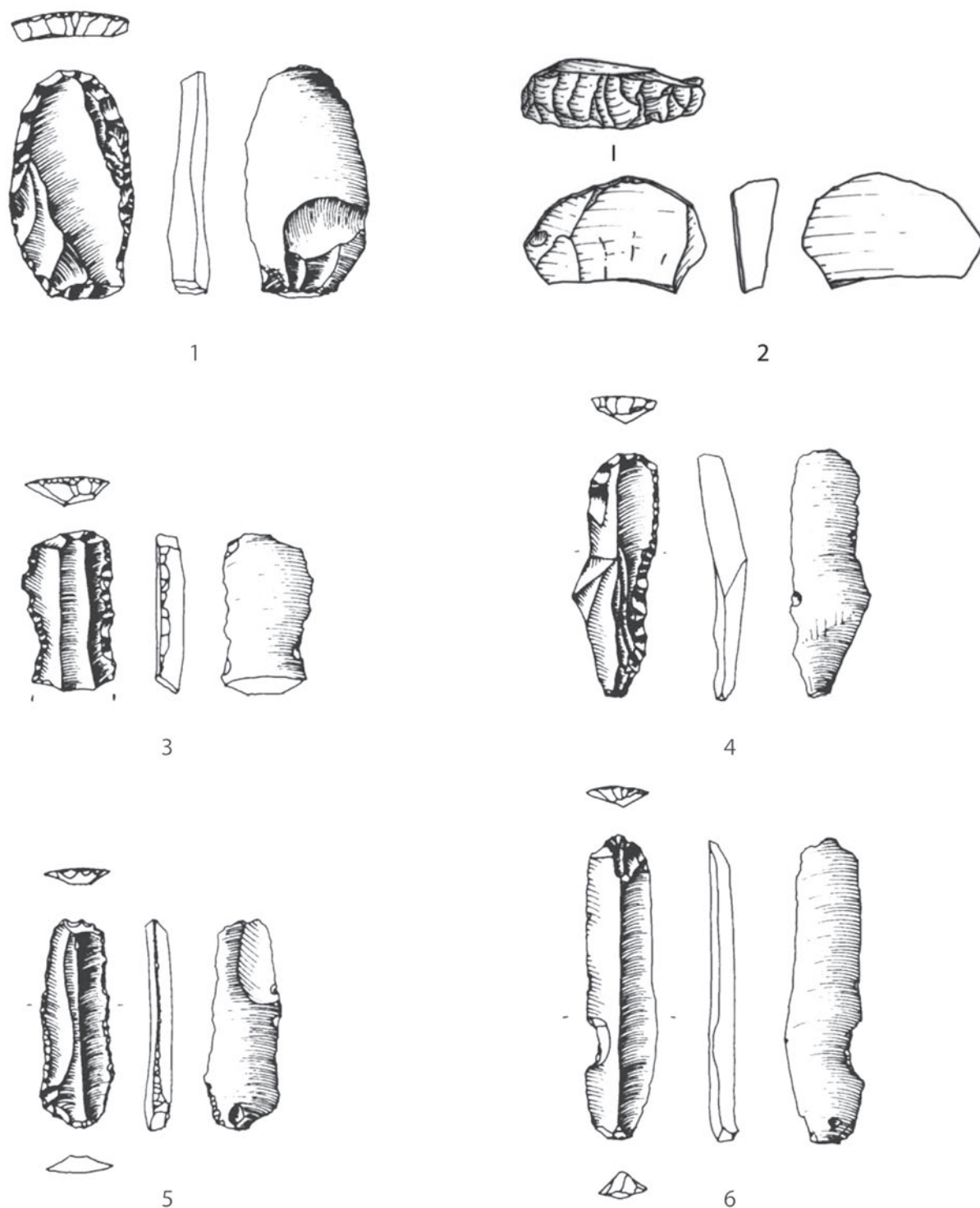


Figure 9.8. End-scrapers. 1: End-scraper on retouched entire flake (61 β), obsidian, Trench B1, FN/LN disturbed. 2: End-scraper on broken thick blade (91 α), obsidian, Trench B1, FN/LN disturbed. 3: End-scraper on notched blade (688 δ), obsidian, unstratified. 4: End-scraper on blade broken at the proximal end (686 β), obsidian, unstratified. 5: End-scraper on retouched blade (90 β), obsidian, FN/LN disturbed. 6: End-scraper on blade with accidental notch at the left edge (686 γ), obsidian, unstratified.

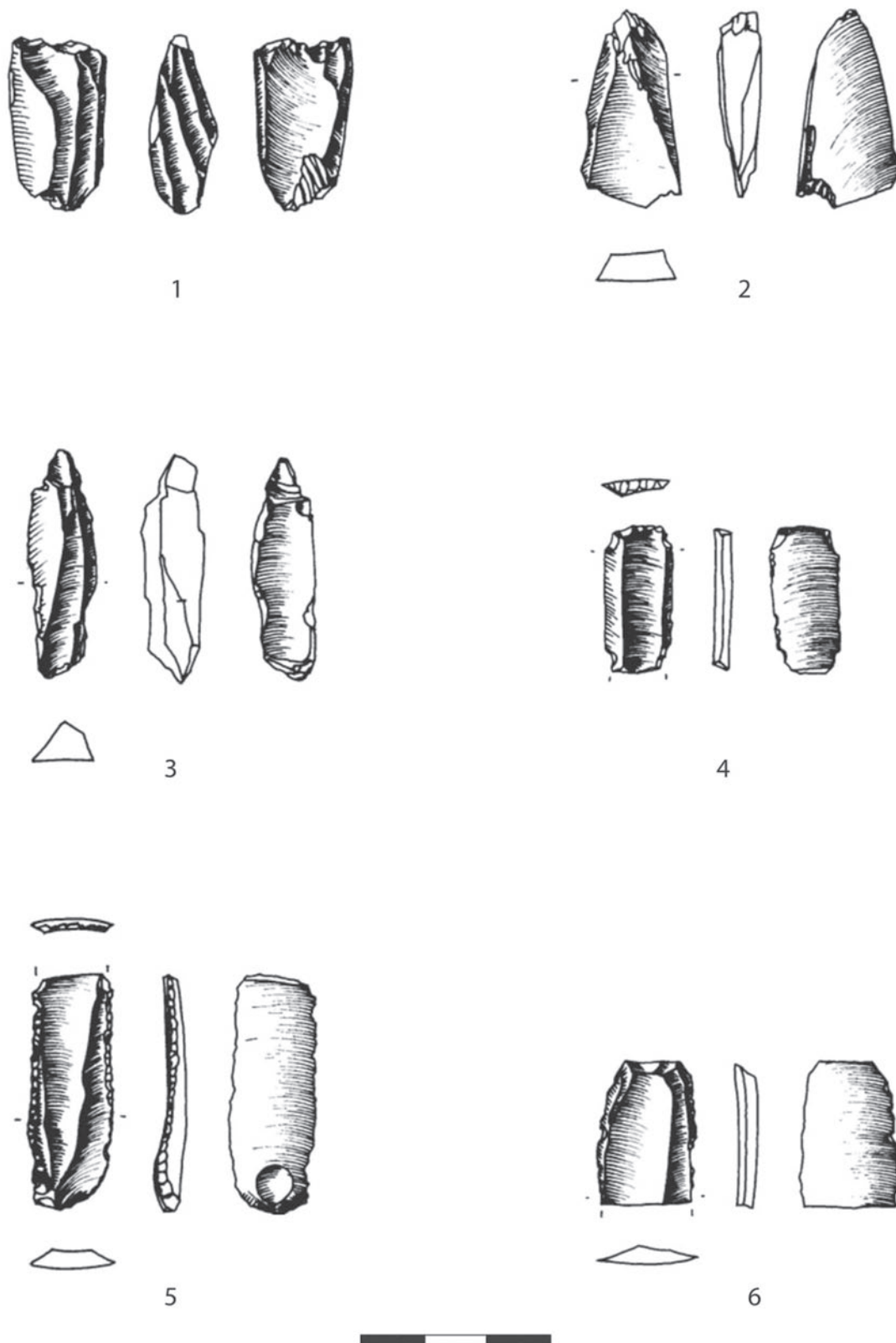


Figure 9.9. Splintered pieces and truncations. 1: Splintered piece on core fragment for blades (78 β), obsidian, Trench B1, FN/LN disturbed. 2: Splintered piece on fragment of flake (163 ϵ), obsidian, Trench B1, FN. 3: Splintered piece en batonnet (97 γ), obsidian, Trench B1, LN. 4: Truncation on distal of blade (92 ι), obsidian, Trench B1, FN/LN disturbed. 5: Truncation on denticulated blade (71 β), obsidian, Trench B1, LN. 6: Truncation on distal of blade (690 γ), obsidian, unstratified.

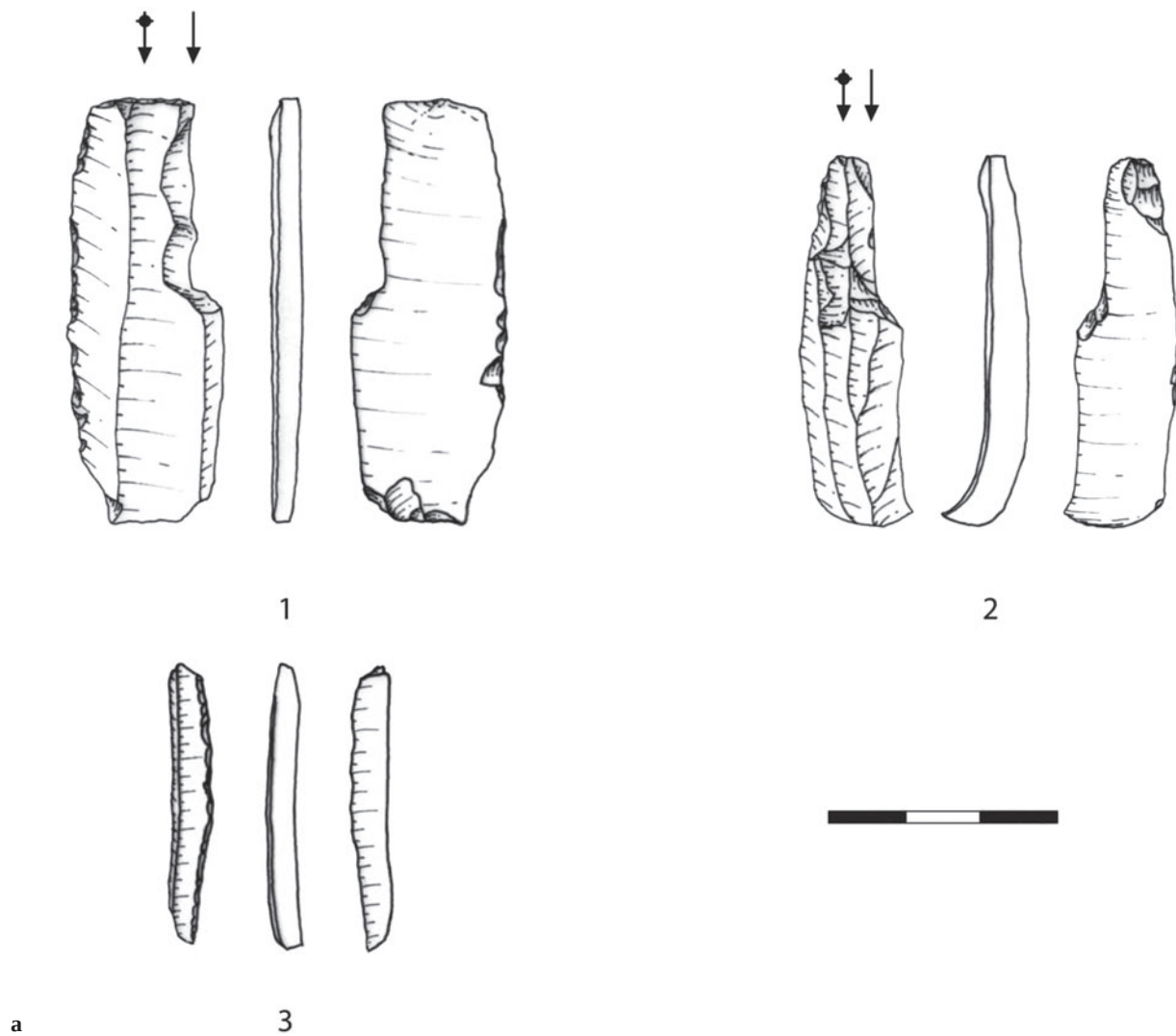


Figure 9.10. Burins 1: Burin on truncation on a retouched blade (307a), obsidian, Trench B2, FN. 2: Burin on plunging blade (no ref.), obsidian, Chamber Z, unstratified. 3: Burin spall with fine retouch (no ref.), obsidian, Chamber Z, unstratified.

derived from a *disturbed* Final/Late Neolithic context ($n = 125$) and yet another significant amount from an *unsecure* Late Neolithic context ($n = 70$); together these represent 60% of the assemblage recovered from Trench B1. The strictly stratified material in this trench coming from secure Late ($n = 93$) and Final Neolithic ($n = 36$) levels amounts to only 128 artefacts. To this Final Neolithic group we can add the artefacts coming from loci B2, B3, B4, B5, B6 and B7 ($n = 202$), as well those from Chamber D ($n = 20$) discussed above. Consequently, the number of the strictly stratified artefacts severely limits the value of the following observations drawn for this cave. No generalisations for the Late and Final Neolithic of southern Aegean are possible.

The first observation, numerically, and taking into account the strictly stratified material from Trench B1, is that the richest levels are those of the Late Neolithic ($n = 93$), while the artifacts drop off by over half in the

Final Neolithic ($n = 36$). A similar situation is observed in Sarakinos Cave, where the Late Neolithic level of Trench A is richer ($n = 402$) than that of the Final Neolithic ($n = 247$).

As for the distribution of the raw materials and especially the presence of the obsidian, there is no a notable difference in its occurrence between Late and Final Neolithic levels in Alepotrypa Cave. Obsidian appears here at a rate of 93.41% in the Final Neolithic levels (against 6.58% of the other siliceous rocks) and at a rate of 94.56% for the Late Neolithic levels (against 5.43% for the other siliceous rocks). A comparison also can be made with Sarakinos Cave, where in the Late Neolithic levels obsidian stands at 94.27% (other raw material is 5.72%), and in the Final Neolithic levels 95.14% (other raw materials are 4.85%).

Examination of the debitage products in the Alepotrypa assemblage shows that blades in both levels outnumber

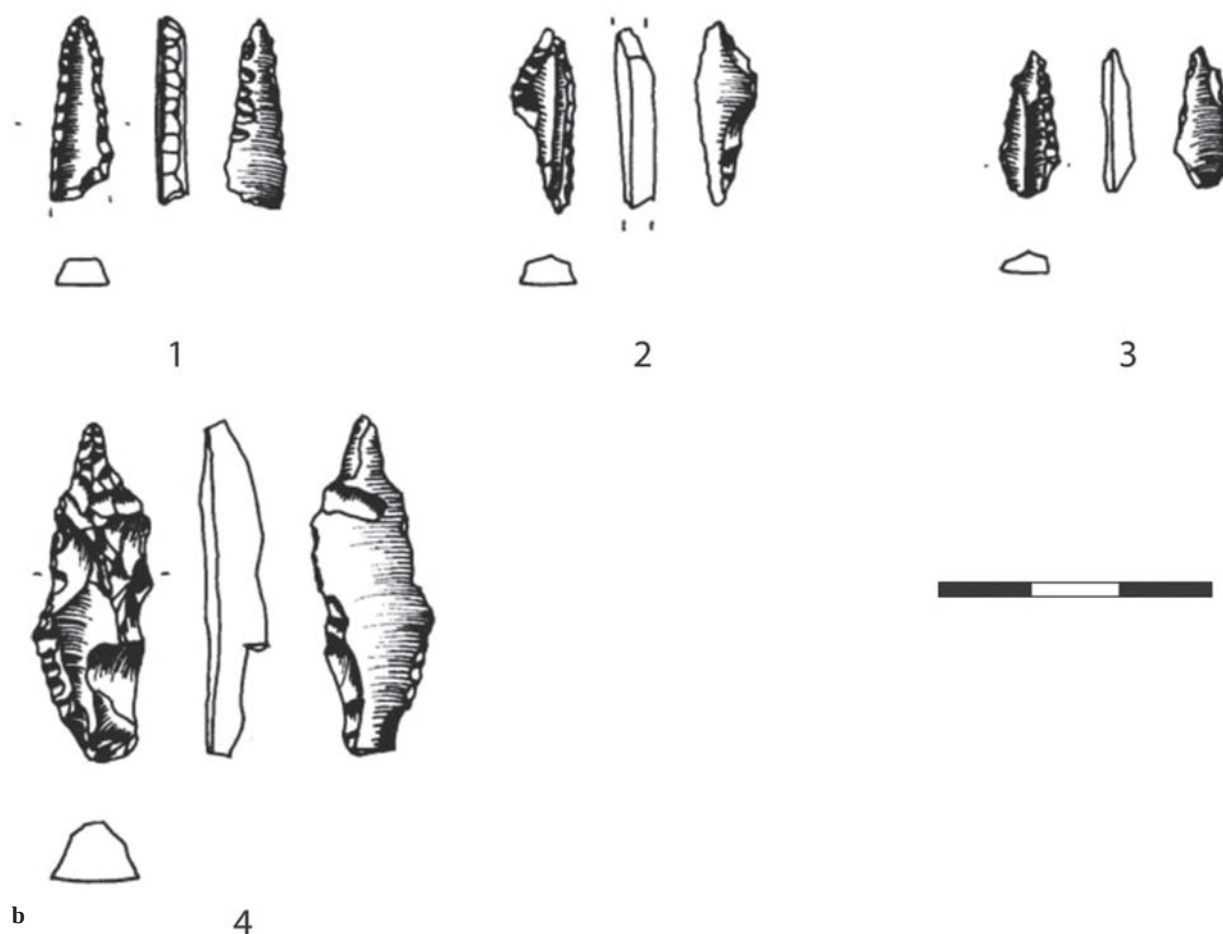


Figure 9.11. Perforators. 1: Perforator on distal fragment of blade (693κ), obsidian, unstratified. 2: Perforator on distal fragment of blade (1156), obsidian, Trench B2, FN. 3: Perforator on an entire bladelet (176), obsidian, Trench B1, FN. 4: Perforator on retouched blade (97ε), obsidian, Trench B1, LN.

flakes, with but slight differences in percentages. In the Final Neolithic levels, blades make up 81.88%, and flakes 18.11%. In the Late Neolithic levels, blades rise to 83.33%, and flakes drop to 16.66%. A comparison with Sarakinos Cave yields a similar situation (Kourtessi-Philippakis *et al.* 2008).

As for typology, tools are proportionately more varied in the Late Neolithic levels ($n = 39$, 41%) than in the Final Neolithic ($n = 71$, 27%). The diachronic occurrence of types deserves some comment. The major tool-groups (*i.e.*, pieces with lateral retouch, notches and denticulates, end-scrapers, and splintered pieces) that are present in the Late Neolithic continue to occur in the Final Neolithic. A similar situation is observed for some minor tool-groups like perforators, burins, and truncations. But projectile points, which appear in the Late Neolithic level ($n = 5$), decrease in the Final Neolithic, where only the stem of one projectile point has been found along with an unfinished and broken one (Figure 9.12 and 9.13). On the other hand, bifacial points occur only in the Final Neolithic ($n = 5$). Finally in Alepotrypa Cave, pieces of flint with gloss occur in the Early Neolithic level (Figure 9.15.2–4), except for

one (Figure 9.15.1) of black flint, which was found in the Final Neolithic level (locus B5).

The above observations lead us to suggest that from the point of view of raw material management as well as technical procedures there is no major chrono-stratigraphical differentiation between the Late and Final Neolithic levels in Alepotrypa Cave. The only point of divergence appears in the distribution of tool types, and especially projectile points in relation with bifacial points. The distribution of these two tool types recalls the situation at Franchthi Cave (Perlès 2004), where projectile points appear in the FLPN IV phase (=Late Neolithic), while bifacial points occur only in the FLPN V phase (=Final Neolithic).

Spatial distribution

The spatial distribution of chipped stone is strongly biased in Alepotrypa Cave. Chamber B, as pointed out before, is the richest locale, with 60.59% of the entire lithic assemblage. Chambers A, D, and Z are poor in lithic finds, including

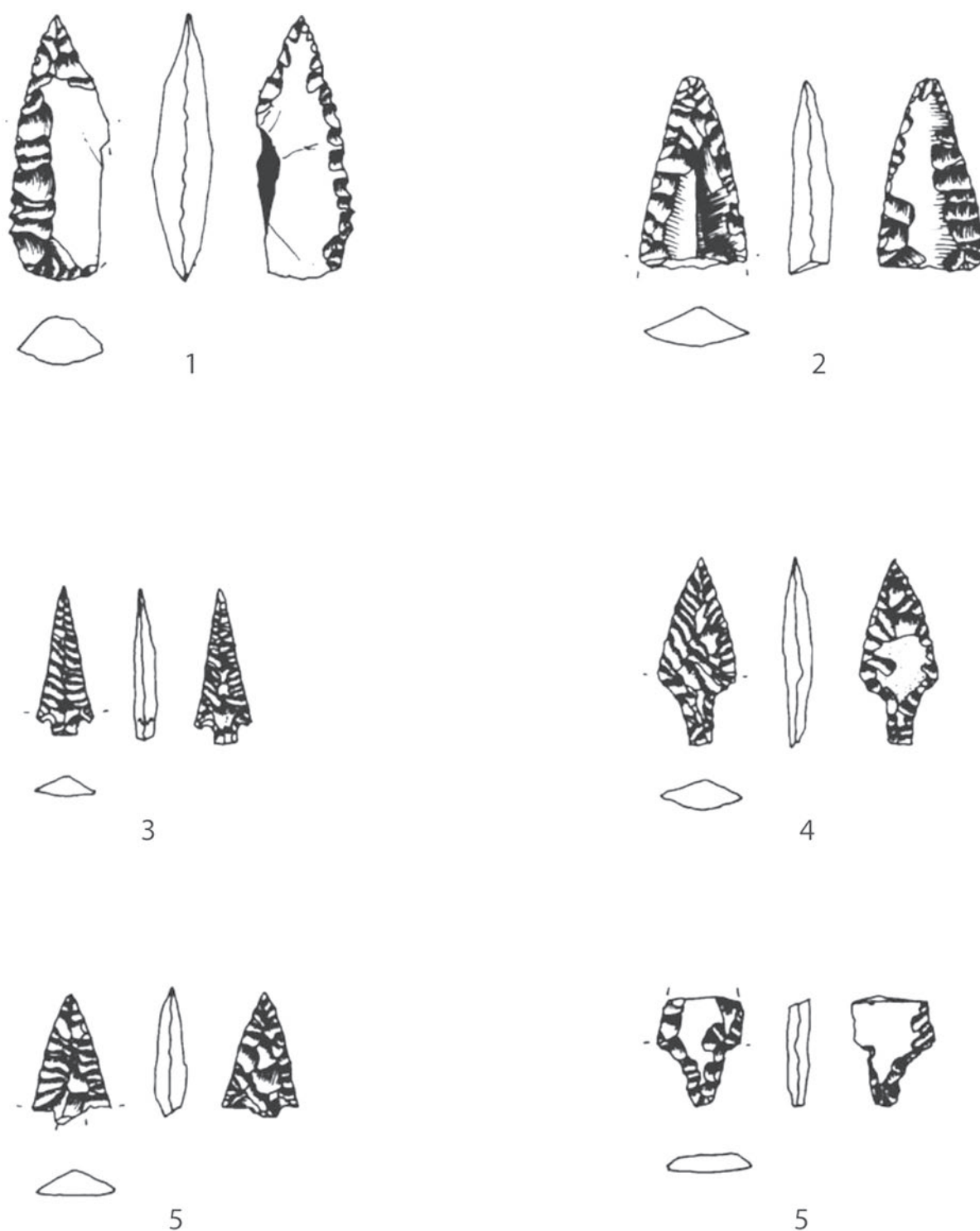


Figure 9.12. Projectile points. 1: Unachieved and broken projectile point (724), beige flint, Chamber D, FN. 2: Projectile point on blade broken at the proximal part (878δ), obsidian, unstratified. 3: Projectile point with broken stem (49), obsidian, Trench B1, LN. 4: Entire projectile point with stem and cortical surfaces (603), obsidian, unstratified. 5: Projectile point broken at its stem (1198), obsidian, Trench B1, FN/LN disturbed. 6: Proximal part (with stem) of a projectile point (303), obsidian, Trench B6, FN.

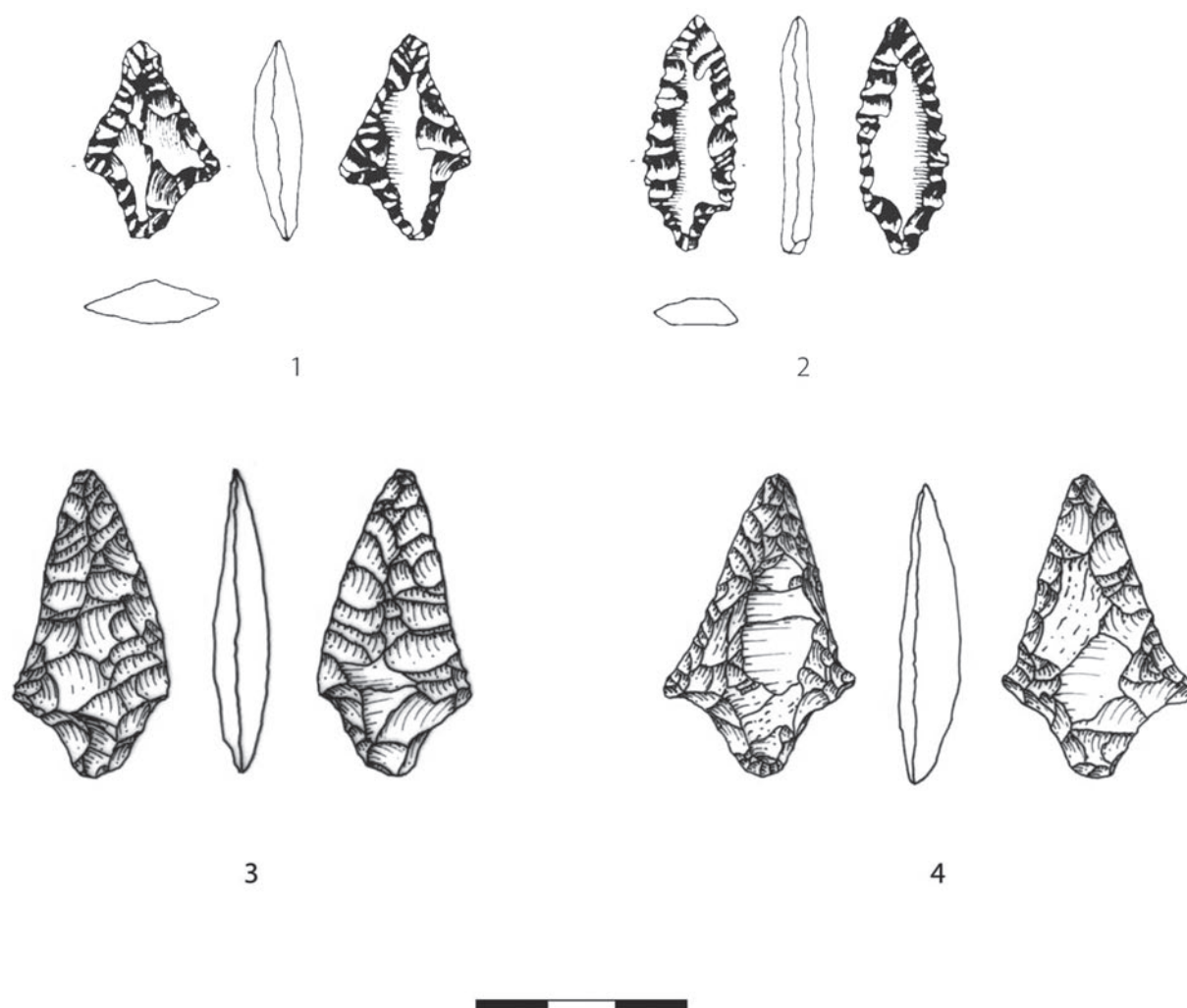


Figure 9.13. Projectile points. 1: Entire projectile point on flake with peduncle formed by two large notches (51), honey flint, Trench B1, LN. 2: Projectile point with denticulated edges (602), obsidian, unstratified. 3–4: Projectile points with triangular peduncle (17058 and 17454), obsidian, Trench B1, LN.

only 67 artefacts (7.71% of the whole assemblage). This quantitative inequality probably is due to the fact that Chamber B housed the principal excavation, Trench B1, which produced an important amount of lithic finds, further supplemented by smaller scale excavations at the different loci within Chamber B. This inequality also may reflect divergent uses of these spaces, with some specific activities having occurred in Chambers A and D (Katsarou, this volume, Chapter 5), as well as in Chamber Z (Psimogiannou, this volume, Chapter 6), which were different than those activities that were carried out in Chamber B. To appreciate the matter in a more nuanced manner, the material will be discussed here chamber by chamber.

Chamber A

Chamber A, where Ossuary I was excavated, is situated near the current entrance of the cave. It was the chamber that suffered the most during the early construction works in the cave. A major part of the archaeological deposits

in Chamber A were destroyed in the construction of two walkways leading to Chamber B. A chronological assignation to the Early Neolithic has been proposed for the archaeological material later found in Chamber A. Among the loci excavated in the Chamber A, only those of A2, A3a, A4, and A8 produced lithic artefacts. This small assemblage consists of eighteen pieces, a mere 2.07% of the entire lithic assemblage from the cave.

Unlike in the Late and Final Neolithic levels of the cave, obsidian is not dominant in Chamber A ($n = 5$, 27.77%), the small sample size notwithstanding. The various flints prevail ($n = 9$, 49.99%), along with the four examples of white patinated flint (22.22%) coming from the loci A2, A4 and A8. The predominance of siliceous rocks of local origin (67%), also has been attested in the FLPN I phase (=Early Neolithic) in Franchthi Cave (Perlès 2004) and a similar situation also has been observed in the Early Neolithic levels (Trench A) of Sarakinos Cave (Kaczanowska *et al.* 2016).

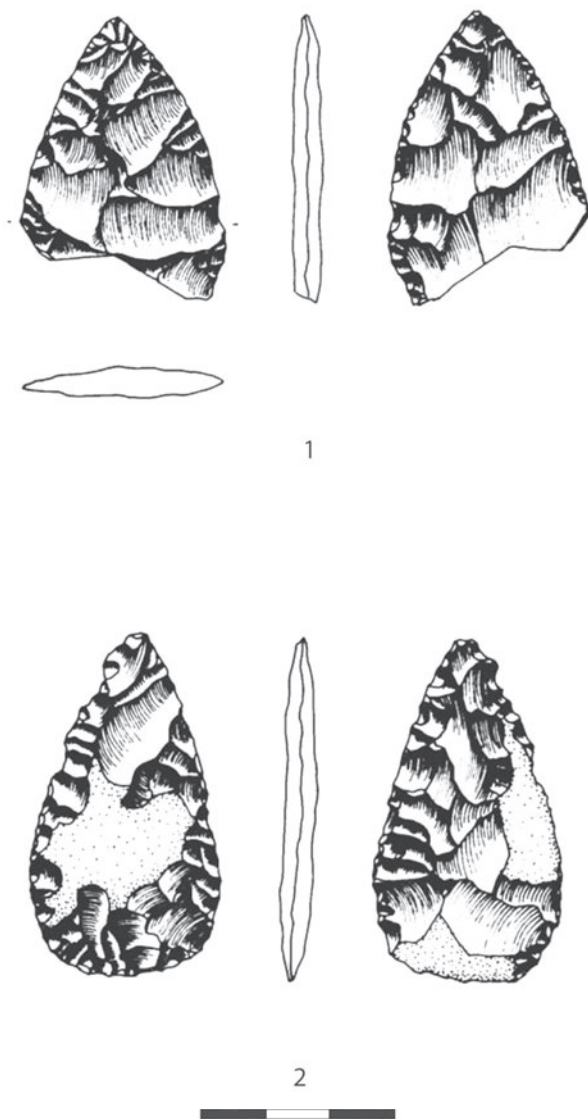


Figure 9.14. Bifacial points. 1: Bifacial point broken at the proximal part (291), grey flint, Trench B1, FN/LN disturbed. 2: Entire bifacial point with cortical surfaces (47), chocolate flint, Trench B1, FN.

The small group of obsidian artefacts from Chamber A includes the following: one piece of debris, one entire bladelet ($2.81 \times 1.25 \times 0.32$ cm), one blade broken away at the distal end ($4.50 \times 1.59 \times 0.41$ cm), one medial fragment of a bladelet with use retouch ($1.05 \times 1.00 \times 0.20$ cm). One tool exists: a large inverse notch shaped on the left edge of a blade broken at the distal end; the right edge has fine, direct, proximal, retouch (Figure 9.6.1). From a technological point of view, the plain butts in this group with abraded overhangs could suggest the preparation of a pressure platform and the use of an organic point, as described in the Early Neolithic of Franchthi Cave (Perlès 2004).

The group of various flints is characterised by a mixture in terms of raw materials. There are flints

ranging from light to dark beige, brown, and black; all have a fine texture. From a technological point of view, there is a high degree of homogeneity, as all the products, except one, are blades that have been used as tools that have acquired a gloss and/or retouch (Figure 9.15.2–4). The grey flint group, also known from the Late and Final Neolithic levels, is represented by a splintered piece on a flake.

Finally, the four white patinated artefacts (Figure 9.16) constitute a unique case in Alepotrypa Cave. It is very difficult to know if their presence in the Early Neolithic period holds any significance, or if might there be a relationship with the ossuary and its secondary burials? Similar pieces with white patina have been collected in the area outside the cave during the recent survey of Diros Bay (Pullen *et al.*, this volume and personal observation). The white patinated assemblage, albeit few in number, belong to a very regular set of blades, with a width of 0.71–1.60 cm.

Chamber D

Chamber D, also known as Ossuary II, is of special interest because of the burials. It contained a small lithic assemblage: 20 artefacts (2.30%) from loci 9, 10, 11, 12 and 14, which are assigned to the Final Neolithic. All the chipped stone objects are of obsidian, except a projectile point made on beige flint. From a technological point of view, the reduction sequence of the obsidian is represented primarily by blades ($n = 3$) and bladelets ($n = 6$). All these products have faceted butts associated with fresh overhangs, in a pattern that suggests the use of copper points and the pressure technique (Perlès 2004). The small tool assemblage of Chamber D comprises three retouched blades (Figure 9.4.4 and 5), one notched blade (Figure 9.6.6) and a projectile point on flint (Figure 9.12.1), types that also are known from the Final Neolithic levels of Chamber B.

Chamber Z

Chamber Z likewise also has a modest lithic assemblage: 29 pieces (3.34%) from loci 22 and 22a, are assigned from the Early to the Final Neolithic. The raw material is exclusively obsidian, and the reduction sequence is only partially represented; there are no cores, no characteristic flakes, no debris. The majority of the artifacts are tools ($n = 17$, 58.62%), followed by fragments of blades and bladelets ($n = 11$), medial for the most part, and a distal fragment of a flake. The size of the blades is comparable with that generally seen in the Late and Final Neolithic layers in the cave, with a width varying from 0.46 cm to 1.23 cm and reaching up to 1.97 cm. The only proximal fragment of a blade has a faceted butt and a fresh overhang. The tool assemblage includes the range of types known from the Late and Final Neolithic levels of the cave, with the exception of perforators, projectile points, and bifacial points, and pieces with gloss. There are

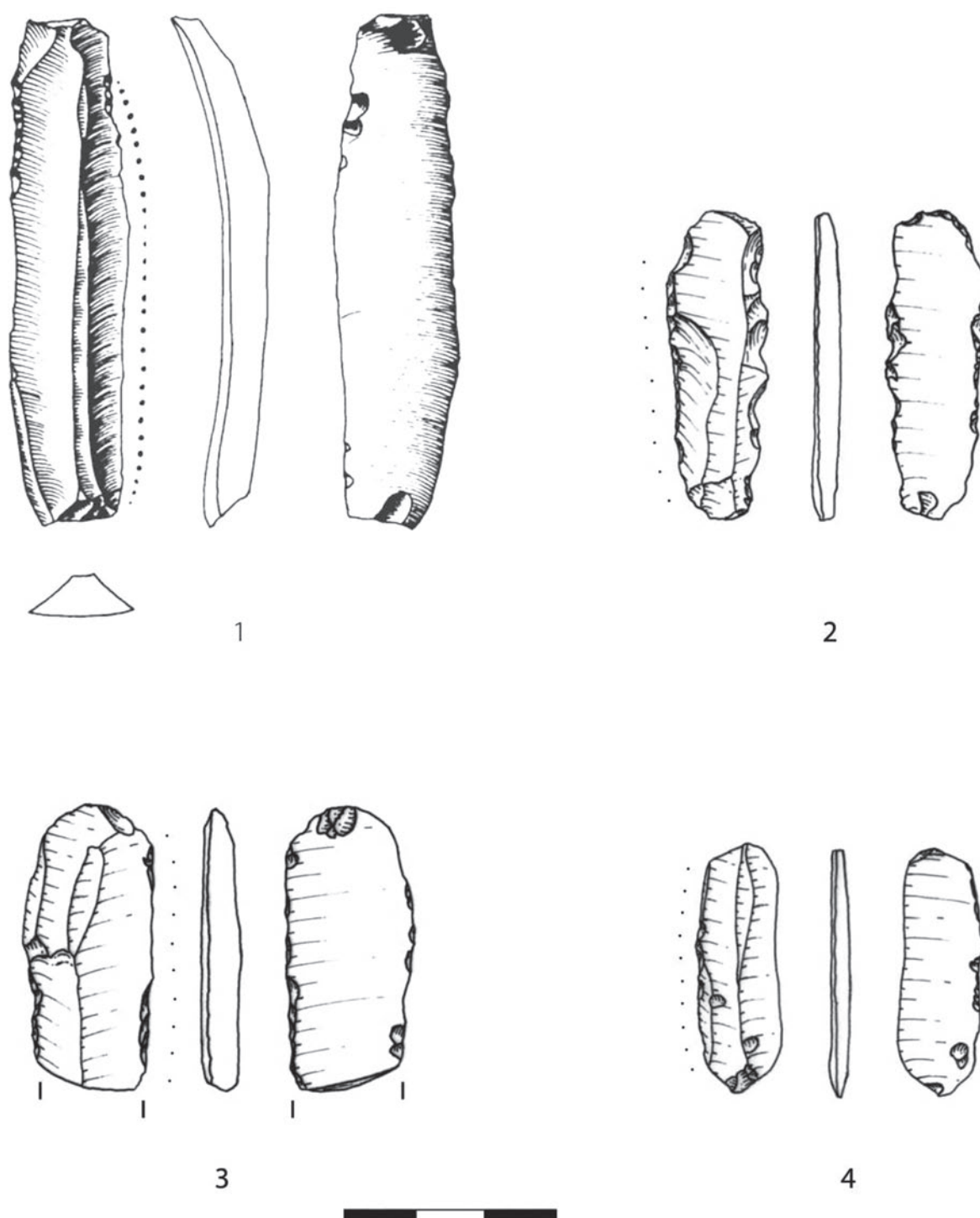


Figure 9.15. Pieces with gloss. 1: Blade broken at both the distal and proximal end with gloss at the right edge (287), black flint, Trench B5, FN. 2: Entire retouched blade with gloss and cortex at the distal end (85), beige flint, Chamber A, EN. 3: Distal fragment of a retouched blade with gloss (54), light brown flint, Chamber A, EN. 4: Entire retouched blade with gloss (57), light brown flint, Chamber A, EN.

retouched blades ($n = 5$) and flakes ($n = 1$) (Figures 9.4.3 and 6 and 9.5.1, 3 and 4), two end-scrapers on a blade retouched on both edges, denticulates on a blade ($n = 4$) (Figure 9.7.2 and 5), one truncation on retouched blade, one burin on a retouched plunging blade (Figure 9.10.2),

two splintered pieces on flakes and one retouched burin spall (Figure 9.10.3). The representation of all the major tool types in this Chamber stands out, but we do not know the reasons for this concentration. Undoubtedly we are dealing here with a closed assemblage, perhaps an

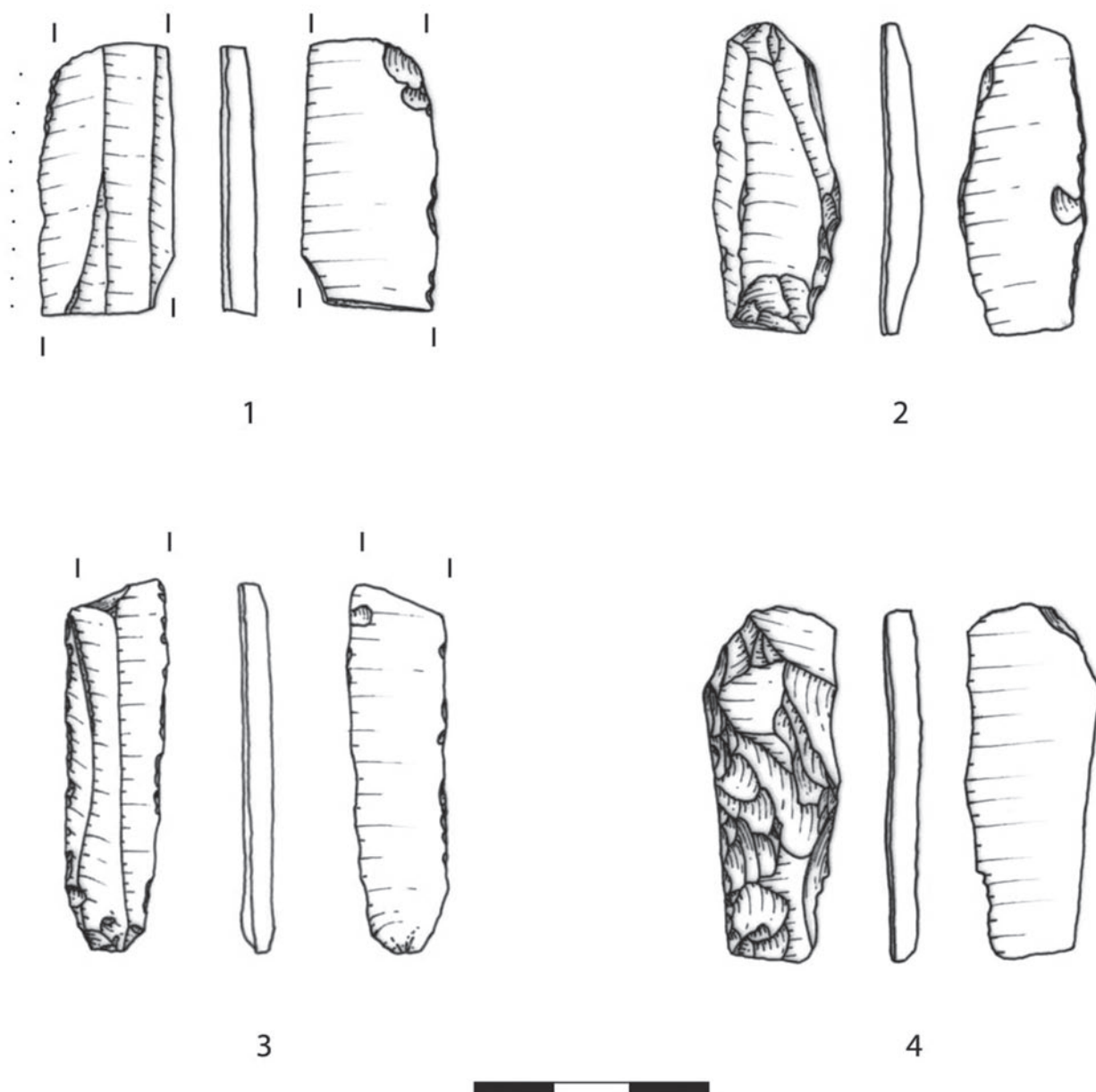


Figure 9.16. White patinated pieces. 1: Medial fragment of trapezoidal blade with use retouch (129), Chamber A, EN. 2: Blade broken at the proximal end with abrupt partial retouch at the right edge (52), Chamber A, EN. 3: Blade broken at the distal end with use retouch (53), Chamber A, EN. 4: Blade broken at the proximal end with stepped retouch (171), Chamber A, EN.

intentional deposit in Chamber Z. The tools are in good condition and do not seem to have been used.

Conclusions and perspectives

Early Neolithic levels provided a small number of lithic artefacts, probably due to the limited area excavated. Despite their small number, this assemblage reveals some particular features of its own, such as a preference for siliceous materials at the expense of obsidian, which is numerically inferior here, and the presence of tools with gloss.

The Late and Final Neolithic chipped stone industries, rich and abundant, confirm through their predominant use of Melian obsidian the existence of a well-structured supply network in which Alepotrypa Cave takes part: this insular, imported volcanic material coexists with flints of continental origin, some local, some from further afield. A variety of techniques, direct and indirect percussion, soft hammer-work, and pressure removal all are employed at Alepotrypa during the same obsidian reduction sequence to produce a predominantly blade-based industry. Flakes and blades were both subsequently selected and transformed by retouch into tools, with a

preference shown for blade blanks. The features of the Alepotrypa Cave assemblage, as they have been detailed in this study, allow its integration into the broader context of caves in central and southern Greece that were inhabited during the Late and Final Neolithic. Even if the issues raised in the introduction related to the supply and distribution of raw materials and the technological systems of production have been resolved somewhat in this study, the question of the character and the nature of the occupation of the cave remains open to discussion. The conditions under which this study was carried out did not allow a full functional analysis to be attempted. In the current situation we do not believe that such an approach would bear positive results. Rather, two other approaches might shed a better light on the nature of the cave occupation and the activities that took place there. First, an overarching comparative study of the different categories of archaeological material (polished and ground tool assemblages, bone tools, ceramics, fauna, etc.). Secondly, the comparison of the cave lithic assemblage with those coming from the open-air sites recently discovered in the vicinity of the cave and further afield.

Acknowledgements

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Bibliography

- Binder, D., Perlès, C., Inizan, M.-L. and Lechevallier, M. (1990) Stratégies de gestion des outillages lithiques au Néolithique. *Paléo* 2, 257–283.
- Cann, R. J. and Renfrew, C. (1964) The characterization of obsidian and its application to the Mediterranean region. *Proceedings of the Prehistoric Society* 30, 111–133.
- Demoule, J.-P. and Perlès, C. (1993) The Greek Neolithic: a new review. *Journal of World Prehistory* 7, 355–416.
- Evans, J. D. and Renfrew, C. (1968) *Excavations at Saliagos near Antiparos*. (British School at Athens Supplement 5). London.
- Galanidou, N. (2002) The chipped stone industry of Ftelia: an introduction. In A. Sampson (ed.), *The Neolithic Settlement at Ftelia, Mykonos*, 317–332. Rhodes.
- Karabatsoli, A. (1997) Η λιθοτεχνία του σπηλαίου των Λιμνών. In A. Sampson (ed.) *Το σπήλαιο των λιμνών στα Καστριά Καλαβρύτων. Μια προϊστορική θέση στην ορεινή Πελοπόννησο*, 485–504. Athens.
- Kaczanowska, M., Kozłowski, J. K. and Sampson, A. (2016) *The Sarakenos Cave at Akraephion, Boeotia, Greece. II. The Early Neolithic, the Mesolithic and the Final Palaeolithic (Excavations in Trench A)*. Krakow.
- Kontaxi, C., Kotzabopoulou, E. and Stravopodi, E. (1995) Προκαταρκτική έκθεση ανασκαφών στη “Α’ Κουβελείκη Σπηλιά” Αλεποχωρίου Λακωνίας. *Athens Annals of Archaeology* 22 (1989), 21–30.
- Kontaxi, C. and Stravopodi, E. (2003) Ανασκαφή στη Β’ Κουβελείκη Σπηλιά Αλεποχωρίου Λακωνίας. *Athens Annals of Archaeology* 32–34 (1999–2001), 19–26.
- Kourtessi-Philippakis, G. 2006. Λίθινες πρώτες ύλες και εγχειρηματικές αλυσίδες της Νεότερης Νεολιθικής στη βόρεια Ελλάδα: Το παράδειγμα του Ντικιλί Τας. *Το Αρχαιολογικό Έργο στη Μακεδονία και στη Θράκη* 20, 115–126.
- Kourtessi-Philippakis, G., 2009. Lithics in the Neolithic of Northern Greece: territorial perspectives from an off-obsidian area. *Documenta Praehistorica* 36, 305–312.
- Kourtessi-Philippakis, G. 2013. Η εγχειρηματική αλυσίδα του οψιανού: Τύποι εργαλείων. In G. A. Papathanassopoulos (ed.) *Το Νεολιθικό Διρό: Σπήλαιο Αλεπότρυπα*, 81–93. Athens.
- Kourtessi-Philippakis, G., 2014a. Lithics in the prehistory of Macedonia: historical and methodological approaches. In E. Stefani et al. (eds), *A Century of Research in Prehistoric Macedonia 1912–2012, International Conference Proceedings, Archaeological Museum of Thessaloniki 22–24 November 2012*, 113–121. Thessaloniki.
- Kourtessi-Philippakis, G., 2014b. Local vs exogène? L’impact du milieu naturel sur la composition des assemblages lithiques néolithiques en Grèce. In G. Touchais et al. (eds), *PHYSIS. L’environnement naturel et la relation homme-milieu dans le monde égéen protohistorique, Actes de la 14e Rencontre égéenne internationale Paris, 11–14 Decembre 2012*, 15–22. (Aegeum 37). Leuven-Liège.
- Kourtessi-Philippakis, G., Kozłowski, J. K. and Kaczanowska, M. (2008). Les industries lithiques taillées de la grotte de Sarakinos, Béotie, Grèce: Sondages A (c. 1–22), B et B Extension. In A. Sampson (ed.), *The Sarakenos Cave at Akraephion, Boeotia, Greece, I: The Neolithic and the Bronze Age*, 466–515. Athens.
- Papathanassopoulos, G. A. 1996. Alepotrypa cave, Diros. In G. A. Papathanassopoulos (ed.) *Neolithic Culture in Greece*, 216–229. Athens.
- Papathanassopoulos, G. A. 2011. *Το Νεολιθικό Διρό. Σπήλαιο Αλεπότρυπα*. Athens.
- Pelegrin, J. (1984) Approche technologique expérimentale de la mise en forme du nucléus pour le débitage systématique par pression. In *Préhistoire de la pierre taillée 2. Economie du débitage laminaire*, 93–103. Paris.
- Pelegrin, J. (1988) Débitage expérimental par pression: “Du plus petit au plus grand”. In J. Tixier (ed.) *Technologie préhistorique*, 37–53. (CNRS, Notes et monographies techniques du CRA 25). Paris.
- Perlès, C. (1981a) Industries lithiques. In N. Lambert (ed.) *La grotte préhistorique de Kitsos (Attique). Missions 1968–1978*, 129–222. Athens.
- Perlès, C. (1981b) Pierre taillée. In *L’Antre Corycien I*. (Bulletin de Correspondance Hellénique Supplement VII), 162–169. Paris.

- Perlès, C. (1990) L'outillage en pierre taillée néolithique en Grèce: approvisionnement et exploitation des matières premières. *Bulletin de Correspondance Hellénique* 114, 1–42.
- Perlès, C. (1993) Les industries lithiques taillées de Tharrounia. In A. Sampson, *Skoteini Tharrounia. The Cave, the Settlement and the Cemetery*, 448–495. Athens.
- Perlès, C. (2004) *Les industries lithiques taillées de Franchthi (Argolide, Grèce): Du Néolithique Ancien au Néolithique Final*. 3. (Excavations at Franchthi cave, Greece 13). Bloomington.
- Perlès, C. and Vaughan, P. (1983) Pièces lustrées, travail des plantes et moissons à Franchthi (Grèce) (Xe-IVe mill. BC). In M.-C. Cauvin (ed.) *Traces d'utilisation sur les outils néolithiques du Proche-Orient. Table Ronde du CNRS tenue à Lyon du 8 au 10 juin 1982*, 209–224. (Travaux de la Maison de l'Orient 5). Lyon.
- Renfrew, C. (1973) Trade and craft specialization. In D. Theocharis (ed.) *Neolithic Greece*, 179–200. Athens.
- Renfrew, C., Cann, J. and Dixon, J. (1965) Obsidian in the Aegean. *Annual of the British School at Athens* 60, 225–247.
- Skourtopoulou, K. (2000) Chipped stone production in Theopetra cave during the Neolithic period. In N. Kyparissi-Apostolika (ed.) *Theopetra Cave. Twelve Years of Excavation and Research 1987–1988. Proceedings of the International Conference, Trikala, 6–7 November 1998*, 269–292. Athens.
- Tixier J., Inizan, M.-L. and Roche, H. 1980 *Préhistoire de la pierre taillée*. I. *Terminologie et technologie*. Paris.
- Torrence, R. (1986) *Production and Exchange of Stone Tools: Prehistoric Obsidian in the Aegean*. Cambridge.
- Zachos, K. (1999) Zas Cave on Naxos and the role of caves in the Aegean Late Neolithic. In P. Halstead (ed.), *Neolithic Society in Greece*, 153–163. (Sheffield Studies in Aegean Archaeology 2). Sheffield.

Macrolithics: ordinary things in an extraordinary place

Anna Stroulia

To the memory of my father

This chapter presents the macrolithics discovered at Alepotrypa Cave: it starts with an introduction to the site and the assemblage.

The site

Alepotrypa Cave is located on the eastern side of Diros Bay, on the western coast of the Mani Peninsula, in the Peloponnese. It was first explored in the 1950s and 1960s by a group of speleologists under the direction of Anna Petrocheilou (the so-called Petrocheilos team). The archaeological investigations of the cave began in the 1970s and are ongoing (Papathanasiou, this volume).

The cave is a massive, elongated, karstic formation measuring c. 250 m in length and 50 m in maximum width. Its five main chambers are set at different levels and feature impressive stalactite and stalagmite formations. Chamber A is by the entrance, followed by chambers B, D, Z, and L (Figure 2.8; CPI 3). All the chambers were used during the Neolithic period (c. 6,000–3,200 cal BC). The use of the cave came to an end after its entrance was blocked by fallen boulders – probably the result of an earthquake (Papathanasiou, this volume).

The main excavated feature of Chamber A (Figure 2.9) is the so-called Ossuary I (A/3 and A/4). It includes four mortuary components. The first three consist of: a small pile of bones belonging to newborn twins (lowest), the articulated burial of a child, and the disarticulated remains of another child (highest). On the basis of radiocarbon dating, they are all attributed to the Early Neolithic phase (EN). The fourth and topmost component contains a large mass of disarticulated human bones. No radiocarbon dates are available for this component. It is tentatively attributed to EN as are a few other excavated areas of Chamber A

(*e.g.*, A/1, A/2, and A/5). Originally, this chamber contained later deposits as well. They were removed by the Petrocheilos team before the archaeological investigations of the cave began (Papathanasiou 2001; Petrocheilos and Petrocheilos 1961; Katsarou, this volume).

Of all the chambers, Chamber B is the most thoroughly investigated (Figure 2.12; CPI 6). Its central sector consists of a mound over 2.5 m in height that covers an area c. 10 × 10 m. Before the Petrocheilos team interventions, it was even larger as it extended into Chamber A. Stratigraphical Trench B/1 has been dug through this mound. This trench has reached a depth of over 5 m and is now close to the bedrock. The excavated strata span from the Early Neolithic (EN) to the Final Neolithic (FN). They yielded three mortuary components: an EN primary burial of an adolescent, a Late Neolithic (LN) multiple burial consisting of skeletons, articulated limbs, and disarticulated bones of at least nine individuals, and a Late/Final Neolithic (LN/FN) single primary female burial. They also yielded a sequence of carefully constructed clay floors/platforms, multiple areas with traces of burning (hearths?), a large clay-lined pit (so-called *βόθρος*), and many fragments of large vessels presumably used for storage. Only the highest, FN strata of the northern sector of Chamber B were excavated. They yielded many fragments of substantial sized vessels, a large hearth, and two large, cylindrical, virtually empty clay-lined pits (Papathanasiou 2001, 33–34 and this volume; Papathanassopoulos 2011, 31; Katsipanou-Margeli, this volume; Karkanis, this volume).

In Chamber D, excavation targeted four niches. The bedrock was not reached in any of them. The excavated deposits are securely or tentatively assigned to FN. One of the niches contained the so-called Ossuary II (D/9

and D/10) consisting of 14 human skulls and many other bones belonging to individuals of both sexes and various ages. Several of the skulls lacked mandibles and were placed upright in circles of stone or inside broken pots (Papathanasiou 2001, 33; Katsarou, this volume). Not far from Ossuary II are Niches D/11 and D/12. On the surface of D/11 five complete vessels were found *in situ*. D/12 yielded three circular or ovate clay thermal features (so-called *urvoi*) in an area with ashes, burnt pieces of wood, and animal bones. It has been hypothesised that both niches played a role in rituals associated with the skeletal remains of Ossuary II (Papathanassopoulos 2011, 32). Whether true or not, the fact that these niches have a low ceiling and are located in a completely dark portion of the cave indicates non-utilitarian functions. The fourth investigated niche of Chamber D is D/14. On its surface stood a pot whose mouth was covered by a smaller, inverted vessel. A series of alternating layers with evidence of burning and clay floors/platforms were found in lower levels, whereas the bottom of the sequence included a few human remains (Papathanassopoulos 2011, 31–34; Papathanasiou, this volume; Karkanas, this volume; Tsartsidou, this volume).

A very narrow passage leads from Chamber D to Chamber Z (Figure 3.18). The latter yielded the most spectacular findings. The excavation of Niches Z/22 and Z/22a uncovered a large number of deliberately broken fine decorated pots. In nearby Niche Th 31, similar smashed vessels covered the partial disarticulated remains of two children. The layer of broken pots extends to the rest of Chamber Z and the beginning of Chamber L. Most interestingly, this layer is mixed with burnt animal dung. There is no doubt that this assemblage represents the remains of ceremonies. The latter took place in the course of a period that started in late EN and ended in FN (or EN–FN; Papathanassopoulos 2011, 34–35; Papathanasiou, this volume; Psimogiannou, this volume; Karkanas, this volume).

Chamber L, a magnificent space with a 35m-high domed ceiling and a pool of water, has been investigated only through surface collection (CPI 8–10). The latter produced a scatter of human and animal bone as well as pottery. This chamber was probably used for the procurement of potable water, but its complete darkness, its substantial distance from the entrance, and the human bones indicate additional non-utilitarian functions. Indeed, human bones were found scattered throughout the cave. They seem to represent the outcome of specific mortuary practices rather than the result of intentional or unintentional burial disturbances (Papathanassopoulos 2011, 50–51; Papathanasiou, this volume).

The assemblage

The material category discussed in this chapter is artificial. It consists of stone tools which, because of their raw

material, manufacturing techniques, and/or use wear, have been excluded from the lithic (or chipped stone) assemblage (see Kourtesi-Philippakis, this volume). This category is also heterogeneous: it includes *a posteriori* tools (*i.e.*, pebbles or cobbles modified only by use, not through manufacture), tools manufactured by abrasive and/or percussive techniques (*i.e.*, flaking, pecking, and grinding), as well as tools that carry abrasive and/or percussive use wear (smoothed or battered surfaces, ground cutting edges, etc.). Such artefacts have been traditionally referred to as ‘ground stone tools’ (*e.g.*, Stroulia 2010; Winn and Shimabuku 1989; Wright 1991). As pointed out, however, this term is problematic, since it is employed for tools made or used as much by percussion as by abrasion (*e.g.* Adams 2002, 1–2; Wright 1991, 1992). I have chosen not to use the traditional term and opted instead for ‘macrolithics,’ proposed by Adams et al. (2009). I consider this term more appropriate for three reasons: 1) It is general enough to accommodate both the artificial and the heterogeneous character of the category under study; 2) It reflects the fact that most (but not all) of the tools in this category are more massive than those identified as chipped stone tools; 3) It underlines the fundamental continuity between the stone tools that are included in the category of chipped stone tools and those excluded from it (see also Wright 2013).

The Alepotrypa macrolithic assemblage comprises 289 items. Regarding their origin, they can be divided into three groups. The *first group* includes 202 specimens (70% of the assemblage). They are accompanied by more or less specific provenience information. All but seven were recovered during the archaeological excavations inside the cave. The exceptions were excavated in an area immediately outside the cave entrance called Exterior Excavation Area A or collected by archaeologists on the surface in specific locations inside the cave. No detailed contextual data for this group’s specimens were available to me as I did not have access to the excavation journals. Less than a third of these specimens are inventoried: their name consists of a number and the prefix D (for Diros), *e.g.*, D407. The name of the non-inventoried specimens consists of their provenience information only. It includes the chamber, trench, and unit in which these specimens were found (*e.g.*, B/1/85), or, more rarely, only the chamber. Multiple non-inventoried specimens with identical provenience are distinguished by a bracketed number added as a suffix to their name, *e.g.*, A/1/4[2].

The *second group* consists of 32 specimens (11% of the assemblage). They were collected inside the cave (and perhaps also immediately outside the cave) by the Petrocheilos team. Specific provenience information is lacking for these specimens. Most, but not all, are inventoried. The name of the inventoried specimens usually consists of a number and the suffix P (for Petrocheilos) (*e.g.*, 17680P). More rarely, it consists of a number with both the prefix D and the suffix P (*e.g.*,

D881P) or one number with the prefix D and another with the suffix P (see D880-34P). The name of the few non-inventoried specimens consists of a number and the suffix AL-P, *e.g.*, 21AL-P (AL for ALepotrypa).

The *third group* comprises 55 specimens (19% of the assemblage). I uncovered no information whatsoever regarding their origin, but it is plausible that they were collected on the surface inside the cave by archaeologists who either recorded relevant information in journals to which I had no access or left behind no relevant record. None of these specimens is inventoried. Their name consists of a number and the suffix AL, *e.g.*, 27AL.

Macrolithics derive from all cave chambers. Close to 70% of specimens with a specific provenience were found in Chamber B. This high concentration is due to Trench B/1, which was dug deeper than any other portion of the cave. Secure or probable dates are available for most specimens with a specific provenience. These are distributed among the EN, LN, and FN phases, with a small number attributed to the Middle/Late Neolithic transition (MN/LN), the Late/Final Neolithic transition (LN/FN), and the period from EN to FN in general (EN–FN).

It has not been possible to subject the macrolithic assemblage to microwear or residue analysis. The examination of all tools has been macroscopic. Neither has the assemblage been subjected to mineralogical, petrographic, or geochemical analysis. Macroscopic examination by Karkanas, however, distinguished four main types of raw material: schist, metavolcanic rocks, limestone/marble, and hematite. Generally speaking, each of these raw material types was used for specific types of tools.

Raw material appears to have been a crucial parameter in the emic classification of the Alepotrypa macrolithics. Accordingly, it is raw material that I have chosen as a structuring principle of my study. In the four following major sections of this chapter, I present each of the above raw material types and discuss the various tool groups for which they were exclusively or primarily utilised.

The discussion of the tool groups is based on two fundamental distinctions originating in the French tradition of tool studies. The first refers to passive and active tools (Laming-Emperaire 1979 cited in de Beaune 1989a, 28). Passive tools remain stable, whereas active tools are moved during use. The two categories are not mutually exclusive. There are tools that played both roles during their use life. The second distinction refers to the four major ways in which the force of the tool is applied to the worked material: 1) abrasion (*percussion posée*); 2) percussion (*percussion lancée*); 3) indirect percussion or percussion with an intermediate tool (*percussion avec percuteur*); 4) combined abrasion and percussion (*percussion lancée et posée*) (Leroi-Gourhan 1971, 47–57; de Beaune 1989a).

The presentation of each tool group is accompanied by a table. It provides basic information for all specimens

included in the group. In each table, complete specimens are listed first, followed by fragmentary specimens. Both complete and fragmentary specimens are presented in order of length. All measurements are in centimeters. An asterisk accompanies the name of the fragmentary specimens whose preserved length (measured along the original long axis) is smaller than the preserved width (measured along the original wide axis). The names of specimens found in certain or likely non-utilitarian contexts are italicised. The tables contain the following abbreviations: Prov = provenience; Pres = preservation; L = length; W = width; T = thickness; L/W = length/width ratio; EEAA = Exterior Excavation Area A; c = complete; f = fragmentary; n/a = non-available; n/ap = non-applicable; EN = Early Neolithic; MN = Middle Neolithic; LN = Late Neolithic; FN = Final Neolithic; MN/LN = Middle/Late Neolithic transition; LN/FN = Late/Final Neolithic transition; EN-FN = Early Neolithic to Final Neolithic; lime/marble = limestone/marble.

The clarification of a few terms used throughout the chapter is in order: 1) The term ‘complete’ refers not only to intact specimens. It is also used for items that are missing one or more small parts, but have complete or almost complete measurements of all three basic dimensions (length, width, and thickness). 2) The term ‘pebble’ is used for a rock measuring no more than 6 cm in maximum dimension; ‘cobble’ for a rock measuring between 6 cm and 25 cm; and ‘boulder’ for one larger than 25 cm (Wright 1992). 3) ‘Reuse’ refers to multiple uses that produced multiple occurrences of a certain kind of wear (*e.g.*, passive abrasive wear) on the same tool. ‘Recycling’ refers to multiple uses that produced different kinds of wear (*e.g.*, passive abrasive and active abrasive wear) on a single tool. A specimen also is recycled if it served a non-tool function after it was used as a tool. ‘Redesigned’ refers to a specific variety of recycled tools which, after having being used in a specific mode (*e.g.*, passive abrasive), were intentionally modified in order to be used in a different mode (*e.g.*, active abrasive; see also Stroulia 2010, 7).

This chapter represents an endeavour in three directions: 1) it provides a detailed, systematic, and balanced analysis of the Alepotrypa material, paying equal attention to formal manufactured tools, manufactured tools that do not belong to well-known types, as well as *a posteriori* tools; 2) it makes comparisons with other assemblages, illuminating trends and exceptions in the Aegean Neolithic macrolithic industry and revealing gaps caused, among others, by unsystematic studies (see also Stroulia 2010); 3) it places the Alepotrypa material in its cave context and discusses it as ‘matter out of place.’

Schist

Schist is the raw material of 91 macrolithic specimens (32%). Coarser and finer grained varieties with different

quantities of mica, quartz, and amphibole, and in different shades of grey were used. For the most part, schist was obtained in the form of water-rolled cobbles and boulders, more rarely in the form of blocks (also affected by water). Such materials are not available at Diros Bay, but could have been picked up in other parts of the western coast of the Mani Peninsula, *e.g.*, the Bay of Neo Itilo immediately north of Diros as well as the bays of Almiros and Marmari c. 20–30 km to the south. If the schist materials of these bays were actually exploited by the people of Alepotrypa, their transportation likely took place by sea.

The majority of the dated schist specimens (60%) are attributed to LN. This concentration does not appear to be the result of excavation biases. Rather, schist and the tools made of it were mostly used during this phase.

Schist was exclusively or primarily used for three groups of specimens: 1. Open abrasive tools; 2. Cavity and groove tools; 3. Miscellanea.

Open abrasive tools

This group comprises 82 specimens with two open, unconstrained faces. With one exception, all are of schist. On the basis of size, morphology, and use wear, I divided the open abrasive tools into three subgroups: 1. Passive; 2. Active; 3. Uncertain.

Passive open abrasive tools

This subgroup comprises 50 schist specimens (Table 10.1). On the basis of their current or presumed original size, use wear, and/or work face configuration, they appear to have been used exclusively or primarily in a passive mode on one or two faces. Among them are the largest and heaviest items in the Alepotrypa macrolithic assemblage.

Tools morphologically comparable to those presented in this section are often referred to as millstones, querns, metates, etc. (*e.g.*, Schelberg 1997; Wright 1992). These terms tend to be associated with food processing. Since it is unclear which of the Alepotrypa specimens were used for grinding foodstuffs, processing minerals, grinding objects to shape, or all of the above, I chose none of the above terms. I opted, instead, for the more neutral ‘passive open abrasive tools.’

Only 15 of the Alepotrypa passive abrasive tools have a known provenience. Thirteen were excavated in Chamber B (12 in B/1), one apiece in Chambers D and L. None was recovered in Chambers A and Z. One specimen was excavated in the area of the LN/FN female burial of B/1, two others were found in Chambers D and L in locations of likely non-utilitarian functions (their names are italicised in the table). Secure or probable dates are available for all 15 items with a known provenience. They are distributed as follows: LN:10, LN/FN:1, FN:4. This distribution shows a clear concentration in LN.

There are only five complete specimens in this subgroup. With one exception, they were recovered by the Petrocheilos team. One of the specimens that I consider

here as complete – 17677P[1 + 2] – actually consists of two pieces. No information is available regarding their recovery. It is thus unknown whether they were found together or at different locations.

The vast majority of specimens ($n = 45$ or 90%) are fragmentary. Alepotrypa is not atypical among Aegean Neolithic sites in the high percentage of fragmentary passive open abrasive tools. High rates of fragmentation are known from Dispilio (Ninou 2006, 28; Touloumis 2002), Stavroupoli (Alisøy 2002), Makri (Bekiaris 2007, 42), Makriyalos (Tsoraki 2007; Yeroussi 1999, 33), Megalo Nisi Galanis (Stroulia 2005a), Franchthi Cave (Stroulia 2010, 31), and Kremasti-Kilada (Chondrou 2010, 91–94; Stroulia and Chondrou 2013; Stroulia *et al.* 2017). In some of these assemblages, the high fragmentation rate has been attributed to processes of deliberate destruction.

The five complete specimens are large, ranging from 31.2 cm to 57.5 cm in length, from 15.3 cm to 30.8 cm in width, and from 4.6 cm to 9.0 cm in thickness. The original tools, from which many of the fragments derive, appear to have had a substantial length and width too. For example, 17678P (Figure 10.1) and 17679P (Figure 10.2) represent roughly one half of tools that measured over 35 cm in length and c. 15 cm in width. Many of the fragments, on the other hand, are relatively thin. I assume that this is the by-product of intensive/prolonged use and that thin specimens are exhausted. Several specimens are at their thinnest at the point of breakage, which seems to be more or less half way along the tool’s length. It is likely that tools split roughly in the middle when this area became too thin to withstand the abrasive pressure applied to it (see also Liebowitz 2008; Starnini and Voytek 1997). 17678P and 17679P can serve as examples in this case as well.

The Alepotrypa passive open abrasive tools appear to be larger than those of other southern Greek mainland sites, such as Franchthi Cave (Stroulia 2010, 37–38), Kitsos Cave (Perlès 1981), and Lerna (Banks 2015, 184; Runnels 1981, 288). They are, however, comparable in size to those recovered in many sites further north, *e.g.*, Sesklo (Wijnen 1982 and pers. observ.), Dimini (pers. observ.), Dispilio (Touloumis 2002), Servia (Mould *et al.* 2000), Sitagroi (Elster 2003b), Dikili Tash (Séfériadès 1992), Stavroupoli (Alisøy 2002), and Kremasti-Kilada (Chondrou 2010, 83–84; Stroulia *et al.* 2017). No comparisons could be made with the material from Kouphovouno, the published site closest to Alepotrypa. The publication (Renard 1989) does not distinguish between Neolithic and Bronze Age specimens.

More than 30 years ago, Curtis Runnels (1985), a pioneer of Aegean grinding tool studies, argued that the Neolithic specimens were small (especially compared to those of the Bronze Age). This argument was based on the limited amount of data available at the time. Obviously, the data base has expanded since then and this

Table 10.1. Schist passive open abrasive tools

Name	Prov	Date	Material	Pres	L	W	T
17677P [1 + 2]	n/a	n/a	schist	c	31.2	22.9	4.6
D742	B/3/94	FN	schist	c	32.0	21.0	4.6
17672P	n/a	n/a	schist	c	34.9	15.3	4.9
17674P	n/a	n/a	schist	c	51.1	30.8	6.0
62AL-P	n/a	n/a	schist	c	57.5	28.0	9.1
B/1/430[1]	B/1/430	LN	schist	f	10.8	9.3	3.2
59AL*	n/a	n/a	schist	f	11.0	11.8	2.3
B/1/336*	B/1/336	LN	schist	f	11.9	14.5	3.8
D442	B/1/82	LN	schist	f	12.1	9.8	5.6
58AL	n/a	n/a	schist	f	12.5	11.4	2.6
D435	B/1/82	LN	schist	f	13.0	8.7	2.2
B/1/49	B/1/49	LN	schist	f	13.1	12.0	2.3
B/1/444[2]*	B/1/444	LN	schist	f	13.4	13.7	2.7
L/38	L/38	FN?	schist	f	13.5	12.6	3.1
21AL-P	n/a	n/a	schist	f	13.5	13.3	3.8
29AL-P	n/a	n/a	schist	f	13.8	11.2	2.9
B/1/379[2]	B/1/379	LN	schist	f	14.2	13.9	4.5
17682P	n/a	n/a	schist	f	14.5	10.9	2.7
3AL	n/a	n/a	schist	f	14.5	9.3	3.1
17681P	n/a	n/a	schist	f	14.9	14.8	2.9
23AL-P	n/a	n/a	schist	f	15.1	10.8	3.7
B/1/81[2]	B/1/81	LN	schist	f	15.2	12.8	3.2
B/1/444[1]	B/1/444	LN	schist	f	15.3	9.1	2.2
32AL	n/a	n/a	schist	f	15.3	9.6	2.8
11AL	n/a	n/a	schist	f	15.3	13.4	4.2
14AL	n/a	n/a	schist	f	15.5	11.1	3.4
D741	B/2/109	FN?	schist	f	15.6	8.9	3.1
17AL	n/a	n/a	schist	f	15.9	9.6	3.7
B/1/39[2]	B/1/39	LN/FN	schist	f	16.0	12.9	3.0
9AL	n/a	n/a	schist	f	16.2	14.2	4.0
15AL	n/a	n/a	schist	f	16.6	11.4	3.4
26AL	n/a	n/a	schist	f	16.8	10.8	3.5
31AL	n/a	n/a	schist	f	17.1	11.8	2.6
D422	D/12/163	FN	schist	f	17.3	8.6	2.4
B/1/84[3]	B/1/84	LN	schist	f	17.4	7.2	3.6
24AL	n/a	n/a	schist	f	17.4	7.5	2.5
17678P	n/a	n/a	schist	f	17.8	15.3	3.4
17679P	n/a	n/a	schist	f	17.8	14.5	3.4
12AL	n/a	n/a	schist	f	18.6	11.8	3.2
20AL	n/a	n/a	schist	f	18.8	10.2	5.2
22AL	n/a	n/a	schist	f	19.0	10.5	3.4
60AL	n/a	n/a	schist	f	19.2	12.9	5.4
17676P	n/a	n/a	schist	f	19.6	16.5	5.3
28AL	n/a	n/a	schist	f	20.1	7.0	4.0
17673P	n/a	n/a	schist	f	22.7	19.3	5.5
17675P	n/a	n/a	schist	f	22.9	18.0	3.7
16AL	n/a	n/a	schist	f	23.0	9.5	3.2
2AL	n/a	n/a	schist	f	24.9	14.6	5.7
25AL	n/a	n/a	schist	f	28.7	12.8	4.0
10AL	n/a	n/a	schist	f	28.9	14.0	5.4

claim needs to be revisited. I would argue that sites, like Franchthi Cave and Lerna, with exclusively small tools (no longer than 30 cm) were the exceptions, not the rule, in the Neolithic, and it is precisely as exceptions that they should be treated (*contra* Valamoti *et al.* 2013).

The few complete Alepotrypa specimens have a generally curvilinear plan. Judging by their preserved parts, most fragments derive from tools of a similar form. With one exception, the dorsal face of single work face

specimens is convex. The exception is 17677P[1 + 2] whose dorsal face is basically flat.

Based on their shape and (current or presumed original) size, most specimens appear suitable for grinding foodstuffs, *e.g.*, cereal grains and pulses such as those found in the cave (Margaritis, this volume). They were likely so used. This hypothesis is supported by the osteological material: the tooth wear often displays a pattern associated with fine particles found in stone

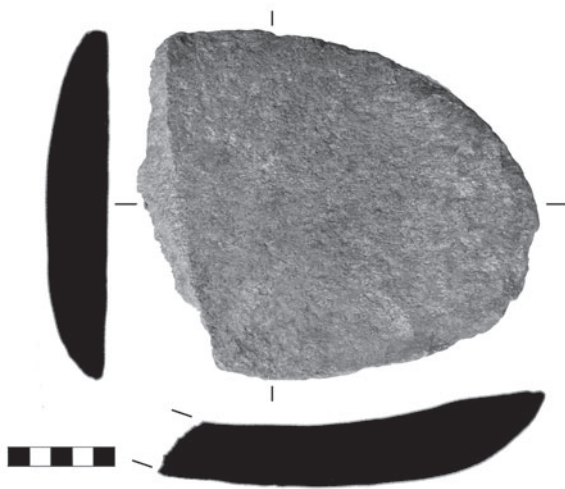


Figure 10.1. Schist passive abrasive tool 17678P: main work face and sections (photo by the author, drawings by V. Trizonis).

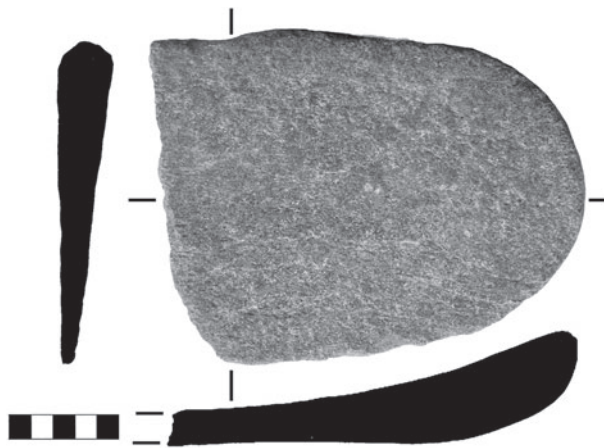


Figure 10.2. Schist passive abrasive tool 17679P: one of the work faces and sections (photo by the author, drawings by V. Trizonis).

ground food (Papathanasiou 2009). The Alepotrypa people probably used passive open abrasive tools in additional grinding tasks, such as the pulverisation of salt or clay. For all these tasks, passive tools were used in conjunction with active implements. These same passive tools may have also been used alone for shaping objects of stone, shell, bone, or other materials (*e.g.*, cutting edge tools, shell ornaments, and bone tools).

Pecking and flaking are the two techniques used to make the Alepotrypa passive open abrasive tools. They were used in the context of repair and redesigning as well. Not all specimens carry traces of both techniques. Evidence of work face preparation is rare, consisting of pecking marks identified at the edges of one of the two faces of 11AL. The fact that pecking marks are limited to the edges implies that: 1) the whole face was pecked to shape and originally covered with pecking marks; 2) the pecking marks at the edges were the only ones preserved as they were less affected by use. One work face, on the other hand, is certainly not manufactured. I am referring

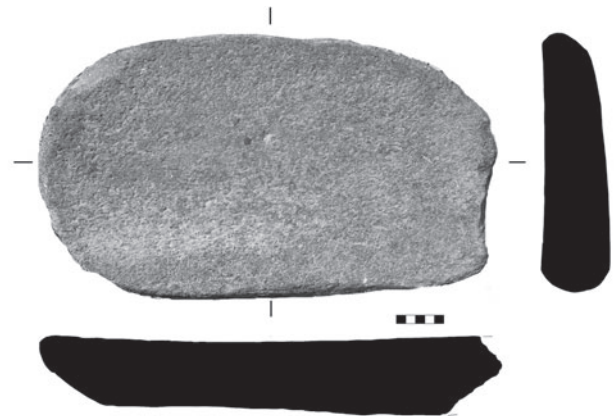


Figure 10.3. Schist passive abrasive tool 62AL-P: one of the work faces and sections (photo by the author, drawings by B. Katsipanou-Margeli).



Figure 10.4. Schist passive abrasive tool 17674P: work face and sections (photo by P. Vezirtzis, drawings by B. Katsipanou-Margeli).

here to one of the two work faces of 62AL-P (Figure 10.3), which was used *a posteriori*. The work faces of some of the remaining specimens were probably prepared by pecking (or even flaking) whose traces were eliminated by subsequent use; others may have been used *a posteriori*.

Evidence of pecking that took place in the context of manufacture may be rare on the work faces of these tools. Yet, a few of them show pecking marks associated with resharpener, *e.g.*, D742, 17681P, and 25AL.

Additional evidence of pecking as well as evidence of chipping is found on the unused portions of these tools. Several specimens were pecked on their dorsal face, sides, and ends, *e.g.*, D442, 17674P (Figure 10.4), and 17675P. Pecking in this case aimed to alter the form of the boulders that served as raw material. One or both sides of a few specimens, on the other hand, are chipped. At times, chipping appears to have occurred in the context of manufacture, altering the plan of the boulder used as raw material, *e.g.*, 17677P[1 + 2]. At others, it probably took place in the context of redesigning: after an accidental fracture or when the passive use of one face was no longer convenient, one

or both sides were chipped in order to facilitate a subsequent active use of the other face. Side chipping reduced the size of the original tool, altered its shape, and/or provided a better hand grip, *e.g.*, 17681P and 17682P.

Almost all specimens preserve both faces. Certain specimens have one work face and an unused dorsal face, others have one work face and limited use wear on the dorsal face, and yet others have two work faces. The work faces of all these tools exhibit a large variety of configurations. For the most part, this variety appears related to use (and related maintenance) and reflects different degrees of use intensity, kinematics, active tools, and processed materials, fewer or more episodes of resharpening, etc.

Thirteen tools have only one work face. Two of the work face configurations found among them are quite straightforward. In the first, the work face is (more or less) concave both longitudinally and transversally or concave/concave, *e.g.*, 17674P (Figure 10.4). In the second, the work face is concave/flat, *e.g.*, 14AL.

Three configurations, on the other hand, are less straightforward. The first is found in fragmentary D442 whose work face is flat along both axes (flat/flat). Such a configuration is compatible with both active and passive tools. The obviously large original size of D442 leaves no doubt that it was used passively.

The second configuration is found in fragmentary 20AL whose work face is flat longitudinally and slightly convex transversally (flat/convex). This configuration is characteristic of active abrasive tools. Yet here an active use is precluded by the tool's obviously large original size. I assume that 20AL was used *a posteriori* in a passive mode and that the slight convexity of its work face is a remnant of its original water-rolled shape. The possibility that this convexity was produced through use cannot be ruled out entirely, however (see Delgado Raack and Risch 2009).

The third configuration is even more intriguing. It is found in D742 and 17675P whose work face is concave longitudinally and convex transversally (concave/convex). Tools with such a work face configuration are known as saddle tools and have been encountered at some other Aegean Neolithic sites, *e.g.*, Franchthi Cave (Stroulia 2010, plates 35, 37, 41, 42), Lerna (Banks 2015, 185), Kremasti-Kilada (Stroulia *et al.* 2017), Platia Magoula Zarkou (Stroulia in prep.), Varemene Goulon (pers. observ.), Kleitos (pers. observ.), and Avgi (Tasos Bekiaris, pers. comm.). Saddle tools are also found in Neolithic, Bronze Age, and Iron Age assemblages in other parts of the world, *e.g.*, Iberia, Belgium, Israel, Sweden, Egypt, and Italy (Delgado Raack and Risch 2009; Hamon 2008; Liebowitz 2008; Lidström Holmberg 2004; Menasanch *et al.* 2002; Robitaille 2015; Samuel 2010; Starnini and Voytek 1997). Some scholars have hypothesised that a concave/convex work face is partly the result of manufacture (transversal convexity) and partly the by-product of use (longitudinal

concavity). There is experimental and ethnoarchaeological evidence that supports this hypothesis (Delgado Raack and Risch 2009; Hamon and Le Gall 2013; Menasanch *et al.* 2002). The same configuration has also been interpreted as the exclusive by-product of use (Lidström Holmberg 2004). The latter hypothesis is supported by my own experiments. Moreover, my experiments, ethnoarchaeological work in Ethiopia by Robitaille, as well as use wear analysis of several specimens from Kremasti-Kilada by Dubreuil have shown that the concave/convex shape is compatible with both passive and active tools (Robitaille 2015; Stroulia *et al.* 2017). It seems that, under certain conditions, both passive and active work faces can evolve from flat/flat to concave/convex as they are used in conjunction with each other. The concave/convex shape of the work face of D742 and 17675P appears to be the by-product of use. The large size of these tools, moreover, leaves no doubt that this use was passive. I consider the concave/convex faces of other specimens of large size discussed in this section to be the by-product of passive use as well.

Five tools have one work face (concave/concave or concave/convex), but also show limited abrasive wear on the dorsal face. Abrasive wear developed on a dorsal face that was naturally convex [17676P, 17678P (Figure 10.1), and 12AL] or had been pecked to a convex shape [17672P (Figure 10.5) and 17673P]. The dorsal face was used passively in all but one cases. The exception is 12AL whose dorsal face was probably used actively after the chipping of one side in the context of redesigning.

Most open passive abrasive tools ($n = 29$ or 58%) have two opposite work faces. In a few cases, one face is smaller than the other, *e.g.*, 17679P (Figure 10.2). Moreover, in several specimens, thickness decreases from one side to the other as the two faces converge, *e.g.*, 17678P (Figure 10.1) and 17679P (Figure 10.2). This is likely the result of extra pressure unconsciously but consistently applied by the user to one side of the passive work face – something that I have experienced during my own experiments (Stroulia *et al.* 2017).

In certain tools, the opposite work faces exhibit a similar configuration: concave/flat, *e.g.*, 17679P (Figure 10.2); flat/flat (28AL); or concave/convex, *e.g.*, 9AL.



Figure 10.5. Schist passive abrasive tool 17672P: main work face and sections (photo by P. Vezirtzis, drawings by V. Trizonis).

In others, the opposite faces have different shapes. The latter are combined in different ways in different tools: concave/concave for one face and flat/flat for the other, *e.g.*, B/1/49; concave/convex and flat/flat, *e.g.*, 24AL; concave/concave and concave/flat, *e.g.*, 21AL; or concave/concave and concave/convex, *e.g.*, 62AL-P (Figure 10.3). The opposite faces could have been used for different grinding tasks. Such a practice is documented ethnographically (see Schroth 1996). It is also possible that they were used by different grinders.

In a small number of specimens, on the other hand, the different configurations of the two faces appear to be associated with different modes of use. For example, one work face of 17682P is concave/concave (pointing to passive use) and the other is convex/convex (pointing to active use). The preserved side is chipped. If my understanding is correct, side chipping occurred as the passive tool was redesigned to serve an active function. 17682P and a few other specimens with similar characteristics represent cases of both redesigning and recycling.

I can think of three scenarios regarding the temporal relationship between the two opposite work faces: 1) Both faces were fashioned from the start and used alternately for different grinding tasks (or by different individuals). This, for example, may be the case with B/1/379[2] whose work faces are similar in shape/size and exhibit a roughly similar degree of use intensity. 2) The two faces were used concurrently for only a certain period of time. In this case, the second face was fashioned and utilised (or used *a posteriori*) after the first had already started being used. This scenario may, for example, fit 62AL-P (Figure 10.3) whose faces show different shapes, sizes, and degrees of use intensity and whose larger and more intensely used face appears perfectly functional. 3) The two faces were never used concurrently. In this case, one work face was prepared and used (or used *a posteriori*) first. When this face was no longer functional, the second one was put to use. This scenario fits specimens such as 17682P, which was used passively with one face and then redesigned to be actively used with the other.

If opposite faces were used for different tasks, in different modes, and/or by different individuals, then double work face tools point to a certain flexible and practical approach regarding the raw material, the tools, and their uses. The Alepotrypa people were flexible as they allowed different usages of the same tool; and practical as they extended the use lives of available tools (by exploiting more than one tool portion) and avoided expenditure of time/energy in the procurement of extra quantities of not readily accessible raw material.

Active open abrasive tools

This subgroup comprises 17 specimens (Table 10.2). On the basis of their current or presumed original size, use wear, and/or work face configuration, they appear to have been used exclusively in an active abrasive mode on one

Table 10.2. *Schist active open abrasive tools*

<i>Name</i>	<i>Prov</i>	<i>Date</i>	<i>Material</i>	<i>Pres</i>	<i>L</i>	<i>W</i>	<i>T</i>
D407	B/1/51	LN	schist	f	7.3	6.8	3.7
B/1/301	B/1/301	LN	schist	f	8.2	6.6	1.4
<i>D/11/147</i>	<i>D/11/147</i>	FN	schist	f	10.9	9.5	2.7
B/1/81[1]*	B/1/81	LN	schist	f	11.1	14.1	2.8
6AL	n/a	n/a	gabbro	f	11.1	11.3	2.5
B/1/500[2]	B/1/500	LN	schist	f	11.9	8.6	2.5
27AL	n/a	n/a	schist	f	12.1	10.2	3.6
5AL	n/a	n/a	schist	f	12.4	7.2	2.8
1AL*	n/a	n/a	schist	f	12.4	16.9	4.4
D478*	B/6/118	FN?	schist	f	12.5	14.3	4.6
B/1/51*	B/1/51	LN	schist	f	12.6	12.8	3.0
18AL	n/a	n/a	schist	f	12.9	8.8	4.0
4AL	n/a	n/a	schist	f	13.3	12.1	3.5
A/7/75	A/7/75	EN?	schist	f	14.0	10.6	2.9
19AL	n/a	n/a	schist	f	15.0	10.1	3.4
B/1/30[1]	B/1/30	LN/FN	schist	f	15.5	10.8	3.5
54AL	n/a	n/a	schist	f	17.0	11.6	3.1

or both faces. All but one are of schist. The exception is 6AL whose material is gabbro.

Tools morphologically comparable to those presented in this section are often referred to as handstones, manos, grinders, etc. (*e.g.*, Hayden 1987; Tsoraki 2007; Wright and Baysal 2012). These terms tend to imply food processing. Since it is unclear which of the Alepotrypa specimens were used for food grinding, processing minerals, or both, I chose none of the above terms. I opted, instead, for the more neutral ‘active open abrasive tools.’

The number of the Alepotrypa open abrasive tools identified as active is about one third of those identified as passive. This is intriguing, since passive and active open abrasive tools often work in pairs. Even more so, since the longer use lives that passive abrasive tools have compared to active ones create the exactly opposite expectation, *i.e.*, a higher number of active than passive implements (see Hayden 1987, 193; Nixon-Darcus 2014, 206–208; Risch 2008). The discrepancy remains substantial even allowing for the fact that at some point in their use life, certain tools classified as passive were recycled to serve an active function (see above).

Nine specimens in this subgroup have a known provenience. Seven derive from Chamber B, one apiece from Chambers A and D. None was recovered in Chambers Z and L. One item was found in D/11, an area of likely non-utilitarian function (its name is italicised in the table). Secure or probable dates are available for all nine items. They are distributed as follows: EN:1, LN:5, LN/FN:1, FN:2.

All specimens are fragmentary. Each fragment is an orphan. No joining pieces were found; they must have been separated at some point after breakage. The fragments appear to derive from tools of curvilinear plans. They range from 7.3 cm to 17.0 cm in length and from 6.6 cm to 16.9 cm in width. Those preserving both faces vary in thickness from 1.4 cm to 4.6 cm. The size and morphology of several fragments suggest that the original



Figure 10.6. Schist active abrasive tool 1AL: work face and profile (photos by the author).

tools were fairly large, *e.g.*, 1AL (Figure 10.6). They were probably used with both hands for grinding foodstuffs and other substances. The thinness of certain specimens, on the other hand, indicates an intensive and/or prolonged use, *e.g.*, B/1/301. These are indeed thin enough to be considered exhausted.

No evidence of manufacture is visible on the work faces of these tools. Such evidence may have been eliminated by subsequent use. Or, more likely, the Alepotrypa people put the faces of the water-rolled cobbles that served as raw material straight to use without prior modification. The work faces may carry no evidence of manufacture, but at least a few of them carry evidence of resharpening, *e.g.*, 19AL.

The unused dorsal faces do not carry evidence of manufacture either. The periphery of three specimens, on the other hand, shows traces of chipping. In 6AL, the chipping seems to have taken place in the context of manufacture. In B/1/30[1] and 1AL (Figure 10.6), it cut into the use wear of the work face/s and must thus be associated to a redesigning process.

The work faces of the active abrasive implements (like those of their passive counterparts), exhibit various configurations. The following discussion offers a glimpse of this variation. Of the 14 specimens that preserve both faces, five have a work face and an unused dorsal face. The work faces of these specimens are flat/convex (*e.g.*, B/1/30[1]) or convex/convex (*e.g.*, D478). The Alepotrypa

people must have used them in conjunction with faces that were concave/flat or concave/concave respectively. As seen above, such work faces do exist among passive open abrasive tools.

Nine specimens (64%) have two opposite work faces. The prevalence of double work face tools over single ones parallels that found among passive open abrasive tools (see above). This reinforces the impression that the Alepotrypa people had a flexible and practical attitude towards open abrasive tools, seeking to get the maximum out of the schist boulders/cobbles brought to the site.

Certain tools have opposite work faces of similar configuration. For example, both faces of B/1/51 are flat/convex, whereas those of 1AL (Figure 10.6) are convex/convex. In other specimens, the two opposite faces show different configurations: flat/convex and convex/convex, *e.g.*, 6AL and 18AL. The Alepotrypa people may have used the opposite faces to process different substances. In this case, both were available for use at the same time. Alternatively, the two faces were used to process similar substances. In this case, the second face started being used when the first was no longer convenient. The possibility that the two faces were used by different individuals cannot be ruled out.

Interestingly, the concave/convex work face encountered among passive open abrasive tools does not have a compatible concave/convex work face among the active implements. I can offer two hypotheses for this absence: 1) for one reason or another some active tools (including those with a concave/convex work face) were discarded outside the cave; 2) some active tools were made of wood and have thus not been preserved. The use of wooden active grinding implements has been hypothesised for a few Neolithic and Bronze Age Greek and Iberian assemblages (see Delgado Raack and Risch 2009; Hadou 2011, 134; Menasanch *et al.* 2002; Tsiolaki 2009, 61–62). I cannot tell which hypothesis is more likely, but either can explain the substantial discrepancy observed between the numbers of passive and active abrasive tools found at the site.

Uncertain open abrasive tools

This subgroup comprises 15 schist open abrasive tools, which I was not able to identify as passive or active and thus include in one of the two subgroups discussed above (Table 10.3).

Twelve tools have a known provenience. All but two originate in Trench B/1. One of the exceptions derives from Chamber A, the other from Chamber D (Ossuary II). Secure or probable dates are available for all 12 specimens. They are distributed as follows: EN:1, MN/LN:2, LN:8, FN:1. This distribution shows a clear concentration in LN.

Only one tool is complete, the rest are fragmentary. The complete and nine of the fragmentary specimens

Table 10.3. Uncertain schist open abrasive tools

Name	Prov	Date	Material	Pres	L	W	T
B/1/82[1]	B/1/82	LN	schist	c	18.8	9.1	2.4
B/1H/370	B/1H/370	LN	schist	f	9.2	6.3	1.3
B/1/48	B/1/48	LN	schist	f	9.7	8.3	1.2
D/9-10/240.32	D/9-10/240.32	FN	schist	f	11.1	9.0	3.1
B/1/466[1]	B/1/466	LN	schist	f	11.6	10.4	3.5
B/1/532	B/1/532	MN/LN	schist	f	12.2	4.9	2.7
D884P	n/a	n/a	schist	f	12.8	3.1	3.6
A/2/6[4]	A/2/6	EN?	schist	f	12.9	7.7	4.2
B/1/448	B/1/448	MN/LN	schist	f	13.0	8.6	2.8
B/1A/370[3]	B/1A/370	LN	schist	f	13.1	8.8	3.3
B/1/467	B/1/467	LN	schist	f	13.3	11.9	2.1
30AL	n/a	n/a	schist	f	14.0	12.3	3.0
B/1/223	B/1/223	LN	schist	f	14.7	8.1	5.0
17680P	n/a	n/a	schist	f	15.5	14.7	2.7
B/1A/370[2]	B/1A/370	LN	schist	f	16.6	12.0	3.1

Table 10.4. Schist cavity and groove tools

Name	Prov	Date	Material	Pres	L	W	T
D190	B/1/35	LN/FN	schist	f	12.0	7.3	1.4
D439	B/1/85	LN	schist	f	13.6	8.8	3.4
17683P	n/a	n/a	schist	f	15.0	12.1	3.7
D425	B/6/119	FN?	schist	f	14.6	6.6	4.0
17684P	n/a	n/a	schist	f	15.1	13.5	4.0
B/1A/370[1]	B/1A/370	LN	schist	f	18.1	12.4	4.1
D406	A/4/21	EN?	schist	f	20.6	18.6	4.7
55AL	n/a	n/a	schist	f	28.5	15.5	5.4
D17673P	n/a	n/a	schist	f	27.4	19.0	5.5

have one or two work faces, but it is unclear if they were used passively or actively. The preserved portions of four other specimens show no use wear whatsoever (D884P, A/2/6[4], B/1/48, and B/1/532). They probably belong to the unused dorsal faces of open abrasive tools. Finally, B/1/223 also seems to preserve an unused portion of an abrasive tool. In this case the broken surface was ground in the context of an unknown task.

Cavity and groove tools

This group comprises nine schist specimens (Table 10.4). They contain a cavity (or depression), a groove, or both. Five of them have a known provenience. Four come from Chamber B, one from Chamber A. No other chambers are represented in this group. Two items were excavated in the LN/FN female burial of B/1 and Ossuary I. Secure or probable dates are available for all five items with a known provenience. They are distributed as follows: EN:1, LN:2, LN/FN:1, FN:1.

This group features two grooves and eight cavities. Both grooves are *a posteriori*. Three of the cavities appear to be *a posteriori*, five appear to be manufactured. All tools are fragmentary. With two exceptions, their cavities and grooves are fragmentary as well. Each of the exceptions has a complete cavity.

At least five specimens consist of open abrasive tools, which at some point were recycled to serve a function that involved a cavity. In at least three cases, recycling

was preceded by redesigning. The redesigned artefacts are not well finished. No effort was made to eliminate broken surfaces or the traces of the redesigning process. Neither time nor energy was invested in providing regular shapes and surfaces. These tools were expediently produced and there was not much concern for their appearance.

The specimens in this group have different forms, manufacturing processes, uses, and histories. They can, nevertheless, be divided into two categories. They are presented below.

The first category includes six specimens probably used to process, mix, contain, or serve various substances. D425, 17683P (Figure 10.7), and 17684P (Figure 10.8) are three of them. They contain a complete or broken circular cavity no more than 10.5 cm in diameter and 1.5–2.0 cm in depth. Each of the cavities was formed on the work face of an open passive abrasive tool. If my understanding is correct, when the original tool accidentally broke, it was flaked peripherally to acquire a suitable size and shape, and a cavity was pecked on one of its faces. Alternatively, when the tool was no longer useful for its original purpose, it was modified into one with a cavity. Either way, these three specimens represent cases of both redesigning and recycling. The cavities could hold only small quantities of material and could have been used in conjunction with some of the metavolcanic specimens later discussed under the name ‘tools used in an active diffused percussive mode with



Figure 10.7. Schist cavity tool 17683P: face and section (photo by P. Vezirtzis, drawing by B. Katsipanou-Margeli).

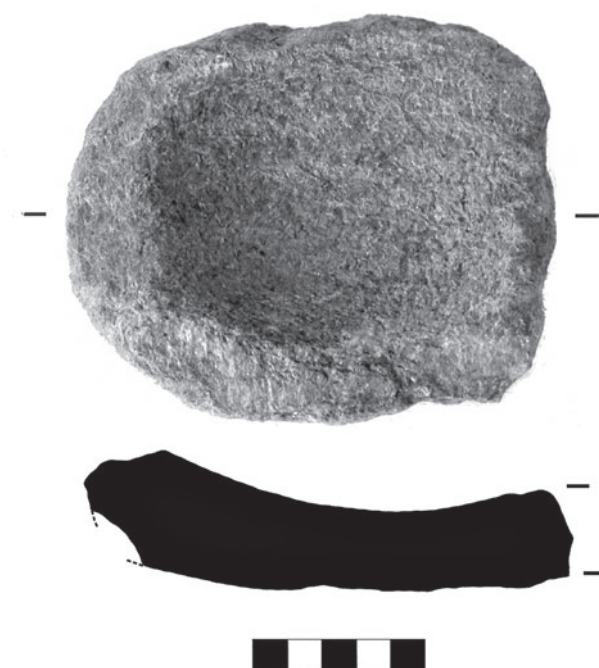


Figure 10.8. Schist cavity tool 17684P: face and section (photo by P. Vezirtzis, drawing by B. Katsipanou-Margeli).

the ends.' I should note, however, that nowhere were examples of these two tool types found in association.

Unlike the above three cavity tools, D17673P (Figure 10.9) was recycled but not redesigned. This is the largest specimen in this category and belongs to a tool that was at least 45 cm long. It preserves about half of a smooth ovate cavity that was c. 22 cm long, 8 cm wide, and 1.3 cm deep. This cavity was shaped on the work face



Figure 10.9. Schist cavity tool D17673P: face and transversal section (photo by P. Vezirtzis, drawing by B. Katsipanou-Margeli).

of an open passive abrasive tool. Given its shape and size, the cavity was likely used as a container and server, not for processing or mixing substances.

D406 and B/1A/370[1] derive from large tools as well. Each contains a portion of a large, 6–7 cm deep cavity with flaring sides. The surface around the cavities is broken, but given the absence of schist tools of thickness comparable to these cavities' depths, it is unlikely that these specimens represent cases of recycling/redesigning. The large size and the very open shape of the cavities indicate containing and serving rather than processing functions.

The second category includes three specimens. They contain grooves and/or cavities formed *a posteriori* through passive abrasive use in the context of shaping or smoothing objects. I present these specimens below:

D439 has two opposite faces. One contains a wide groove, the other a cavity. The groove has a U-shaped cross section and currently measures $7.1 \times 5.3 \times 0.4$ cm. It may have been formed by grinding to shape cutting edge tools (see below), figurines (like those illustrated in Papathanassopoulos 2011, 227–228), etc. The cavity was originally circular and measured no more than 10 cm in diameter and at least 0.5 cm in depth. It may have been used to shape round objects such as those known as maceheads (see below).

55AL is the largest item in this category and consists of a recycled passive open abrasive tool with opposite work faces. The surface of one of the faces is gently interrupted by a cavity of unknown original plan. Its preserved portion measures $12.5 \times 7.3 \times 0.6$ cm. This cavity was probably formed through shaping or smoothing objects.

Finally, D190 (Figure 10.10) consists of a thin fragment (a flake more accurately) of a water-rolled cobble. Its cortical face is lightly convex and contains a pointed groove of a V-shaped cross section. Its preserved length is 7.4 cm, whereas its maximum width and depth are 3.2 cm and 0.3 cm respectively. This groove may have been formed by shaping and/or smoothing pointed bone or wooden artefacts (for some of the Alepotrypa pointed



Figure 10.10. Schist groove tool D190: face and transversal section (photo by A. Iliakopoulos, drawing by V. Trizonis).

bone tools, see Papathanassopoulos 2011, 127–145 and Stratouli, this volume).

Interestingly, the Alepotrypa macrolithic assemblage includes no large and deep cavity tools that could have been used as mortars for dehusking cereals, pounding/cracking grains, etc. Only rarely have tools with such characteristics been identified in Aegean Neolithic sites, see Saliagos (Evans and Renfrew 1968, 71). Some artefacts classified as mortars—from Olynthus (Mylonas 1929, 78) and Knossos (Evans 1964), for example—are clearly not suitable for grain processing. Others—those from Makriyalos (Tsoraki 2007), for example—may or may not be suitable; no details are provided on size or other characteristics. I doubt that the scarcity of such bulky objects is an archaeological construct. Most likely both the Alepotrypa people and other Neolithic communities around Greece used wooden mortars that have not been preserved.

Schist miscellanea

This group includes a single schist specimen – D743 – that fits neither the group of open abrasive tools nor that

Table 10.5. Schist miscellanea

Name	Prov	Date	Material	Pres	L	W	T
D743	B/1/30	LN/FN	schist	c	8.5	4.0	3.5

of cavity and groove tools discussed above (Table 10.5). D743 consists of a water-rolled cobbler with an elongated subtriangular plan and a relatively flat lopsided base. This base includes a red/brown area measuring 2.3×1.8 cm – the result of contact with a pigment in the context of an active abrasive use. The other end is partly broken – perhaps the result of active percussion. D743 is the only item in the entire macrolithic assemblage that carries clear pigment traces. I noticed a similar scarcity of such tools at Franchthi Cave (Stroulia 2010, 130). It seems that at some Aegean Neolithic sites macrolithic tools were rarely involved in pigment processing.

Metavolcanic rocks

Metavolcanic rocks were used for 49 macrolithic tools (17%). These materials consist of relatively hard metamorphic andesites and tuffs of various shades of green and (more rarely) brown. A few specimens show crystals that are darker or lighter than the background. Metavolcanic rocks are found in a single location in the Mani Peninsula: the mountainous area of Krokeai more than 25 km northeast of Diros. The macroscopic similarity between the metavolcanic rocks found at Krokeai and those used at Alepotrypa suggests a Krokeatic origin for the Alepotrypa materials. Yet, for the most part, the metavolcanic rocks that ended up at the site consist of water-rolled pebbles/cobbles, not pieces naturally or artificially detached from outcrops. Metavolcanic water-rolled pebbles/cobbles could have been obtained at secondary sources like the beaches in the area of Githion, on the eastern coast of the Mani Peninsula. It is uncertain whether the procurement of such materials took place through direct expeditions by the Alepotrypa people, exchange with groups that lived closer to the sources, or both. Equally uncertain is whether it involved sea or cross-land trips.

Most dated metavolcanic tools are evenly distributed between LN and FN, with only a small number attributed to EN.

Metavolcanic rocks were used for four groups: 1. Tools used in an active linear mode with the end/s or cutting edge tools; 2. Tools used in an active diffused percussive mode with the ends;¹ 3. Small roughly conical tools with a variety of active wear; and 4. Miscellanea.

Tools used in an active linear mode with the end/s or cutting edge tools

This group comprises 31 items. All but three are made of metavolcanic rocks. The exceptions are of hematite (Table 10.6). Twenty-three tools carry on one end an edge

Table 10.6. Metavolcanic tools used in an active linear mode with the end/s or cutting edge tools

Name	Prov	Date	Material	Pres	L	W	T	L/W
D201	B/1	n/a	metavolcanic	c	2.7	1.5	0.9	1.80
D677a	back-dirt	n/a	metavolcanic	c	2.9	1.4	0.8	2.07
D390	D/9, D/10, D/11, and D/12 back-dirt	FN	metavolcanic	c	3.0	3.1	1.1	0.96
D609	back-dirt	n/a	hematite	c	3.0	2.7	1.0	1.11
D1748	B/1B/245	LN	metavolcanic	c	3.3	2.6	1.0	1.26
D104	B/1/34	LN/FN	metavolcanic	c	3.6	2.6	1.4	1.38
D260	D/9/145	FN	metavolcanic	c	3.6	1.5	0.9	2.40
D680	back-dirt	n/a	metavolcanic	c	3.9	2.6	1.9	1.50
D1252	D/10/185	FN	metavolcanic	c	4.0	1.7	1.0	2.35
D101	A/4/31	EN?	metavolcanic	c	4.6	4.7	1.5	0.97
D16796	B/1/293	LN	metavolcanic	c	4.7	4.7	1.5	1.00
D676	back-dirt	n/a	metavolcanic	c	4.7	3.9	1.7	1.20
D102	B/1/52	LN	metavolcanic	c	4.8	2.2	1.4	2.18
D100	A/3a/32	EN?	metavolcanic	c	5.7	5.2	1.2	1.09
D200	B/3/98	FN	metavolcanic	c	6.1	3.9	1.8	1.56
D157	B/1/82	LN	metavolcanic	c	6.9	3.8	2.5	1.81
D261	D/11	FN	metavolcanic	c	7.0	4.2	3.1	1.66
D121	B, northern sector	FN?	metavolcanic	c	7.2	3.6	3.4	2.00
D262	D/11/148	FN	metavolcanic	c	7.5	4.7	2.8	1.59
D605	back-dirt	n/a	metavolcanic	c	8.7	3.7	2.8	2.35
D152	A/2/3	EN?	metavolcanic	f	1.6	1.3	0.6	n/ap
D156*	A/7/75	EN?	metavolcanic	f	2.2	3.4	0.7	n/ap
D155*	A/3b/41	EN?	metavolcanic	f	3.1	4.3	1.2	n/ap
D1192	EEAA#177	n/a	metavolcanic	f	4.3	3.4	1.9	n/ap
D880-34P	n/a	n/a	hematite	f	5.1	2.5	1.5	n/ap
35P	n/a	n/a	metavolcanic	f	5.7	5.4	2.7	n/ap
D103	B/1/50	LN	metavolcanic	f	6.8	4.6	2.8	n/ap
D881P	n/a	n/a	metavolcanic	f	6.8	4.3	3.2	n/ap
D17633	Z/22/565	EN-FN	hematite	f	7.4	4.0	2.1	n/ap
B/1/269[2]	B/1/269	LN	metavolcanic	f	8.1	4.8	2.3	n/ap
D202	B/3/94	FN	metavolcanic	f	15.4	6.3	4.2	n/ap

that served an active linear function. The edge of seven other specimens is missing: at some point their distal part was broken off or recycled to serve a non-linear function. One specimen has two edges (one on each end).

More or less specific provenience information is available for 23 items. With one exception recovered in the Exterior Excavation Area A (EEAA) immediately outside the cave entrance, they were found in four cave chambers: A (n = 5), B (n = 11, 8 from B/1), D (n = 5), and Z (n = 1). No specimen was recovered in Chamber L.

Ten of the tools with a more or less specific cave provenience (or 45%) were excavated in the area of primary/secondary burials or in locations of likely non-utilitarian functions: LN/FN female burial of B/1, Ossuary I, Ossuary II, Z/22, D/11, and back-dirt (μπαζα) from D/9, D/10 (both make up Ossuary II), D/11, and D/12. With one exception, these tools are not notably different from other specimens in this group. The exception is D260 (Figure 10.11), a unique item that carries one edge on each end (for a parallel, see Moundrèa-Agrafioti 1981, 250). This specimen is interesting in one more aspect: according to information provided by one of the Ossuary II excavators (Catherine Perlès), it was found at the bottom of a pot that contained a human skull (Katsarou, this

volume). D260 as well as the other specimens deriving from secure or likely non-utilitarian settings carry use wear. As such, they may represent utilitarian objects that ended their use lives in non-mundane contexts (*e.g.*, material placed with their dead owners or offered to the dead by the living). Alternatively, use wear may have resulted from exclusive use in special contexts.

Secure or probable dates are available for 21 specimens. The distribution of 20 of them is as follows: EN:5, LN:6, LN/FN:1, FN:8. The single item from Chamber Z is generally attributed to EN-FN.

Twenty tools are complete. This number includes specimens whose distal portion was recycled to serve a secondary function. Ten specimens are fragmentary. The complete items range from 2.7 to 8.7 cm in length ($\bar{x}$ = 4.8 cm), from 1.4 to 5.2 cm in width ($\bar{x}$ = 3.2 cm), and from 0.8 to 3.4 cm in thickness ($\bar{x}$ = 1.7 cm). The above dimensions define relatively small tools. In this sense, the Alepotrypa specimens are similar to those of some southern Greek mainland sites, such as Franchthi Cave (Stroulia 2003; 2010, 71), Kitsos Cave (Perlès 1981), and Tharrounia (Sugaya 1993), but smaller than others, such as Lerna (Banks 2015, 187–197). Interestingly, sites further north have generally yielded larger specimens;

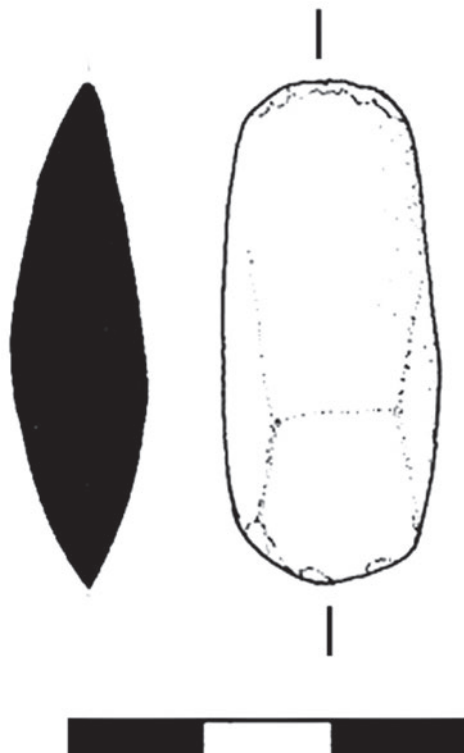


Figure 10.11. Metavolcanic cutting edge tool D260: face and longitudinal section (drawing by B. Katsipanou-Margeli).

see Sesklo, Dimini, and other southeastern Thessalian sites (Moundrèa-Agrafioti (1981, 199–200), Theopetra Cave (Christopoulou 2000), Servia (Mould *et al.* 2000), Olynthus (Mylonas 1929, 63–75), Sitagroi (Elster 2003a; 2003b), Stavroupoli (Alisøy 2002), Dikili Tash (Séfériadès 1992), Paradeisos (Hellström 1987, 85–86), Iliotopos (Hadou 2011, 42–70), Dispilio (Sratouli 2002), Kremasti-Kilada (Chondrou 2010, 67–69; Stroulia 2014), Makri (Stroulia 2005b), and Varemene Goulon (pers. observ.).²

The Alepotrypa cutting edge tools are generally small, but some are smaller than others. I have divided the complete specimens into two groups according to length. The first group comprises items no longer than 5.7 cm. The second includes items with a greater length. I call the members of the first group ‘small,’ those of the second group ‘large.’ I made a similar distinction between ‘small’ and ‘larger’ specimens for the cutting edge tools from Franchthi Cave (Stroulia 2010, 66). The terms ‘small’ and ‘large’ are site specific. Their referents within discussions of other assemblages are different (*e.g.*, Moundrèa-Agrafioti 1981, 199–200).

At Alepotrypa, the simple classification between small and large tools likely reflects an emic distinction. As shown below, the members of the two groups were manufactured, utilised, and hafted in different ways. A paper on cutting edge tools published a few years ago includes this general question: ‘Does size matter?’

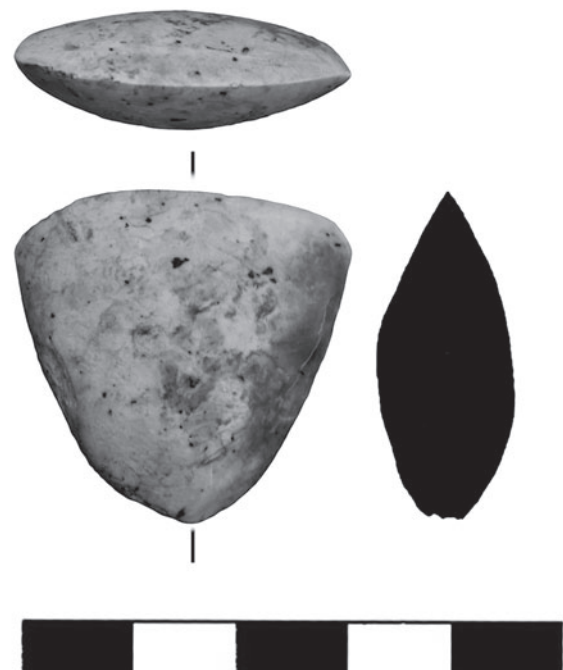


Figure 10.12. Metavolcanic cutting edge tool D390: face, longitudinal section, and edge (photos by the author, drawing by B. Katsipanou-Margeli).

(Tsoraki 2011a, 239–240). For the Alepotrypa specimens, the answer is an emphatic yes!

There are 14 small complete specimens. One question worth asking is rather obvious: why are they so small or, in other words, what does their small size/length actually represent? Most of these tools carry lighter or heavier evidence of resharpening. It can be assumed that resharpening affected these tools’ length and this is indeed suggested by their relatively low length/width ratio average of 1.60. Yet, no technomorphological characteristics indicate that these tools were originally much longer and that their low current length is the result of repeated resharpening. This is true even for two triangular specimens – D101 and D390 (Figure 10.12) – whose length/width ratio is below 1.00. Neither is such a hypothesis supported by a strong correlation between length and length/width ratio. More than anything else, the small length of these tools and their small size in general seem to represent the intended product of manufacture. I reached a similar conclusion for the ‘small’ specimens from Franchthi Cave (Stroulia 2003; 2010, 71–73).

There are only six large complete specimens. None exceeds 8.7 cm in length. The Alepotrypa people did use some longer/larger tools, however. This is suggested by fragmentary D202 (Figure 10.13); currently measuring 15.4 cm in length, it is longer than all large complete specimens and was even longer when intact. Moreover, it is the widest and thickest item in the whole group.

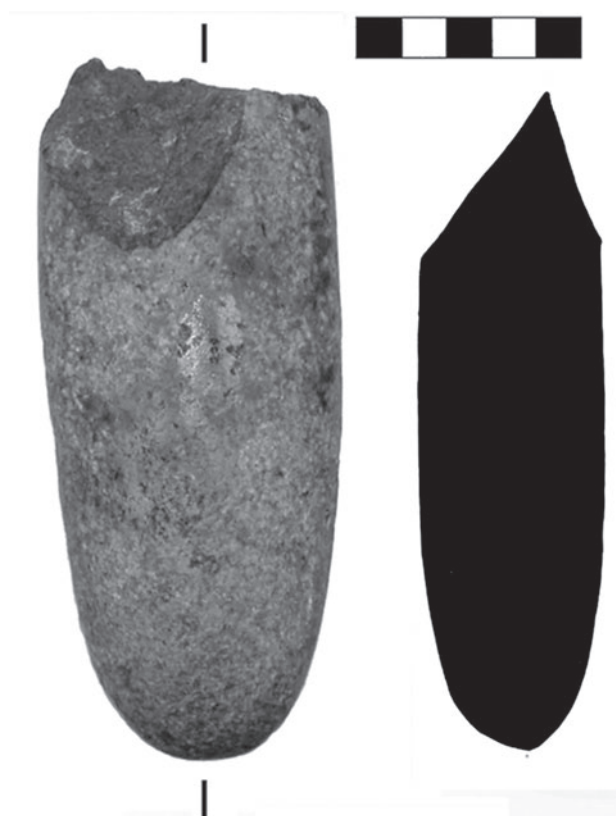


Figure 10.13. Metavolcanic cutting edge tool D202: face and longitudinal section (photo by A. Papathanassopoulou, drawing by B. Katsipanou-Margeli).

This tool must have been perfectly capable of carrying out heavy duty cutting and chopping tasks, including tree felling.

Specimens securely identified as roughouts were not found. Fragmentary 35P, nevertheless, is a possible candidate as it contains both ground and natural water-rolled surfaces. If actually unfinished, 35P can be taken as evidence of local cutting edge tool production. I should note here that the excavations yielded a number of unmodified metavolcanic water-rolled pebbles. Some are too small even for small cutting edge tools. Others have suitable sizes for small tools. They may have not been brought to the cave with such an intention, however; or so is suggested by the recovery of some of them in dark portions of the cave and of at least one in Ossuary II.

Two manufacturing techniques are represented among the Alepotrypa cutting edge tools: grinding and pecking. Not all specimens carry evidence of both techniques. Indeed, the manufacturing sequence appears to have been different for small and large specimens. The body of the 14 small complete tools is more or less homogeneously ground, lacking evidence of pecking, *e.g.*, D390 (Figure 10.12). I doubt that the absence of pecking traces is the result of elimination by subsequent grinding. It appears rather that the metavolcanic pebbles that served

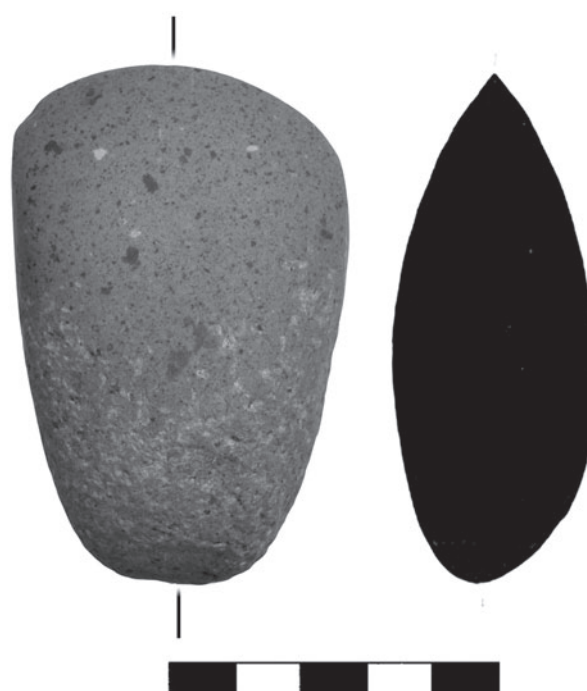


Figure 10.14. Metavolcanic cutting edge tool D262: face and longitudinal section (photo by the author, drawing by B. Katsipanou-Margeli).

as raw material were shaped by grinding alone. Grinding gave these tools their shape, a smoothed or even polished texture, and an acute edge on one end (and, in one case, both ends). The exclusive use of grinding to make small tools is known from other sites, such as Franchthi Cave (Stroulia 2003; 2010, 71–73).

The complete large specimens carry evidence of not only grinding but also pecking. Interestingly, the traces of the two techniques are distributed in specific ways on these tools' body. The distal part of the body is more or less systematically ground. The median and proximal parts, on the other hand, show traces of both pecking and grinding. In certain specimens, these portions are not fully ground; traces of an earlier pecking stage are still visible, *e.g.*, D202 (Figure 10.13). They may have been left partially ground, because they were inserted into a haft and therefore hidden. Additionally or alternatively, incomplete grinding may have been chosen to create a relatively rough area that could better secure the stone head to its haft (Dickson 1981, 33, 99). In other tools, the median and proximal parts appear ground and pecked over, *e.g.*, D262 (Figure 10.14). Such post-grinding pecking probably aimed to produce a relatively rough surface that could facilitate hafting. No traces of a pre-grinding pecking stage are visible in the latter tools, but, given their substantial size, such a stage is likely. Both partial grinding and post-grinding pecking of the median and proximal parts have been encountered among large specimens from Franchthi Cave (Stroulia 2003; 2010, 68–69).

Pecking is carried out with percussive tools. The Alepotrypa macrolithic assemblage includes a number of such tools (see below). Yet, their raw material is mostly limestone/marble – not hard and dense enough for pecking. Only one percussive tool – metavolcanic D128 – is suitable for such a use. In general, it seems that the percussive implements used in the manufacture of cutting edge tools were not deposited in the cave. Grinding is conducted with the help of abrasive surfaces. Such surfaces may have been provided by some of the passive open abrasive tools as well as the cavity and groove tools discussed above.

The Alepotrypa cutting edge tools carry no evidence of flaking. I doubt that such evidence existed, but was eliminated by subsequent treatment. Neither has any metavolcanic flaking debris been found to support such a hypothesis. I rather believe that flaking was not used in making these tools. The absence of flaking aligns the Alepotrypa cutting edge tools with those of other southern Greek mainland sites that were generally manufactured by pecking and grinding alone: Franchthi Cave (Stroulia 2003; 2010, 68), Kitsos Cave (Perlès 1981), and Lerna (Banks 2015, 188). Flaking (along with pecking and grinding), on the other hand, was used to make such tools in several northern Greek sites: Kremasti-Kilada (Chondrou 2010, 62–66; Stroulia 2014), Makriyalos (Tsoraki 2011b; Yeroussi 1999, 61), Dispilio (Stratouli 2002), Makri (Stroulia 2005b), Megalo Nisi Galanis (Stroulia 2014), and Varemni Goulon (pers. observ.).

The Alepotrypa specimens lack evidence of sawing as well. This is another element that aligns this assemblage with those from other southern Greek mainland sites, such as Franchthi Cave (Stroulia 2010, 68) and Kitsos Cave (Perlès 1981), but differentiates it from northern Greek ones, such as Nea Nikomedeia (Rodden 1962), Sesklo (Moundrèa-Agrafioti 1981), Dispilio (Stratouli 2002), Olynthus (Mylonas 1929, 65), Servia (Mould *et al.* 2000), Makriyalos (Tsoraki 2011a; Yeroussi 1999, 35–37), Agios Petros (Efstratiou 1985, 45), Iliotopos (Hadou 2011, 42–70), Avgi (Tasos Bekiaris, pers. comm.), Megalo Nisi Galanis (Stroulia 2005a), Kremasti-Kilada (Stroulia 2014), Platia Magoula Zarkou (Stroulia, in preparation), and Varemni Goulon (pers. observ.). Admittedly, the number of assemblages studied from southern Greece is much smaller than that from the northern part of the country, but the above divergences may point to different cultural traditions and/or technological needs between the two areas.

The process of manufacture of (most) cutting edge tools must have included a hafting stage. No hafts were recovered at Alepotrypa. They must have been fashioned out of wood and other perishable materials as were those found at lakeside settlements of the Amindeon Basin in northern Greece (Chrysostomou *et al.* 2015).

Three main plans are represented in this group: (sub)triangular, (sub)rectangular, and (sub)trapeze. No particular preference for any of the three has been

detected. No association between a specific size and shape has been noted either.

In general, small complete specimens have an asymmetrical profile, *e.g.*, D100 (Figure 10.15). There are, on the other hand, only three complete specimens with a clearly symmetrical profile: D261, D262 (Figure 10.14), and D605. All three are large. This contrast may be an indication that an asymmetrical profile was a choice essentially reserved for small specimens, whereas a symmetrical one was considered an appropriate choice mainly for large ones.

Only one of the complete tools has an edge that is straight in plan: small specimen D680. All the others have an edge that is lightly or strongly curved. The same pattern is found among fragmentary specimens. The curved edge is a manufacturing choice, but may also reflect the water-rolled origin of the raw material.

Five complete tools have an edge that is (lightly or strongly) curved not only in plan but frontally as well, *e.g.*, D100 (Figure 10.15) and D390 (Figure 10.12). All are small. Tools with a similar edge are known from several other Aegean Neolithic sites: Franchthi Cave (Stroulia 2003, 21; 2010, 74), Sesklo (Moundrèa-Agrafioti 1981), Dikili Tash (Séfériadès 1992), Stavroupoli (Alisøy 2002), Kremasti-Kilada (Stroulia 2014), Platia Magoula Zarkou (Stroulia, in preparation), Megalo Nisi Galanis (pers. observ.), and Varemni Goulon (pers. observ.). I suspect that more such tools exist in assemblages that have not been published systematically.



Figure 10.15. Metavolcanic cutting edge tool D100: face, longitudinal section, and edge. (Photos by the author, drawing by B. Katsipanou-Margeli).

All specimens exhibit macroscopic use wear on their edge. In most small specimens, the wear is not continuous along the edge. Rather, the latter is in a reasonably good or even excellent state with evidence of damage (*i.e.*, chips and nicks) restricted to a few spots, *e.g.*, D390 (Figure 10.12). This indicates that only a portion of the edge came into contact with the worked material at any one time. A few specimens show more extensive use wear, *e.g.*, D16796 and D104. Yet, even in these cases, it seems that only a portion of the edge came into contact with the processed material at any one time. The wear visible on most small specimens is compatible with a use in indirect percussion. If my understanding is correct, most of these tools were used in a way similar to that of modern metal chisels: they served as intermediate devices, through which the percussive force of mallets was applied to the worked materials.

In general, small tools do not carry clear evidence of battering on their butt. They must have been inserted into a haft and it was the haft, rather than the tool's butt, that received the percussive force of the mallet. This is a reasonable hypothesis: given their small size, these tools would have been hard to hold during use without a haft. The haft must have been arranged in a way that extended the long axis of the stone head.

Without use wear and/or residue analysis, the precise functions of the small specimens cannot be determined. Woodworking (probably fine), nevertheless, is the most likely (although not necessarily the sole) context of use for these implements. It is noteworthy that a few of them seem to be too small even for fine woodworking tasks, *e.g.*, D201. Whatever the uses of the small specimens may have been, they were rather intensive; or so is suggested by the widespread evidence of resharpening. No small specimen was recycled.

Unlike their small counterparts, large cutting edge tools were probably used in a direct linear percussive mode. If so, they must have been hafted differently: either like typical axes (with the haft parallel to the edge) or like typical adzes (with the haft perpendicular to the plane of the stone head). The aforementioned roughness of the median and proximal portions of several large items could have served to better secure the stone head to its haft – an important consideration in the context of direct and thus more or less violent percussion. The involvement of these tools in such percussion is indeed suggested by their damaged or blunt edges, *e.g.*, D261.

The precise uses of the large specimens are not known. It seems, however, that they were generally suitable for shrubby clearing or woodwork, but most were rather small for tree felling.

Large cutting edge tools were not resharpened, but were recycled – two more substantial differences with small specimens. It seems that when their edges became blunt or damaged, there was no effort to extend their use lives through resharpening. Instead, such tools were

either discarded or recycled to serve other functions. This perhaps implies that the Alepotrypa people had no need for more large tools than those (few) that were available. Similar observations were made for the large cutting edge tools found at Franchthi Cave (Stroulia 2003, 2010, 73, 77).

Three kinds of recycling have been identified in large specimens. All involve use in a non-linear mode. The first targeted the distal part of the body. In this case, presumably, if not necessarily, a blunt or damaged edge started being used in an active diffused percussive mode, *e.g.*, D103. The second affected the proximal portion of the body. In this case, the butt was used in an active diffused percussive mode. It is found on a single specimen (D605). The third is found also on a single specimen (D881P). This tool's broken surface was ground, but it remains unclear why.

The assemblage includes a possible case of curation that did not consist of resharpening. I am referring here to D676 (Figure 10.16), a specimen that seems to have been redesigned after breakage. D676 has two roughly parallel sides and a very low length/width ratio of 1.20. Its butt is lopsided and carries anomalies only partially covered by grinding. I suspect that this tool was originally much longer, at some point its proximal portion was broken off, and then the broken surface was ground in order to produce a new butt and a new complete tool.

I close this section with two small fragments that apparently derive from large tools. D155 (Figure 10.17) and D156 consist of flakes containing an edge portion, a portion of one face, and a much smaller portion of the other face. Each flake has a bulb of percussion, an indication that it was detached deliberately, not accidentally in the context of regular use. The edge in both cases is obtuse and thus unlike the edges of the other tools in this group. So-called resharpening flakes – edge flakes



Figure 10.16. Metavolcanic cutting edge tool D676: face and profile (photos by the author).



Figure 10.17. Metavolcanic cutting edge tool D155: faces and profile (middle) (photos by the author).

deliberately removed in the context of resharpening – have been reported from a few sites, *e.g.*, Makriyalos (Yeroussi 1999, 61–62), Selevac (Voytek 1990), and Çatalhöyük (Wright and Baysal 2012). No details on their characteristics are given, however. I doubt that D155 and D156 represent resharpening flakes, since, as noted earlier, the large cutting edge tools from Alepotrypa carry no evidence of resharpening. It is possible that these flakes were removed in the context of deliberate destruction as I have argued for several edge flakes found at Franchthi Cave (Stroulia 2003; 2010, 75–77). The suspicion of deliberate destruction has been raised for other cutting edge tool assemblages in Greece and beyond (*e.g.*, Barkai 2005; Edmonds 1993; Larsson 2011; Pétrequin *et al.* 2002; Stroulia 2014; Stroulia and Chondrou 2013).

Tools used in an active diffused percussive mode with the ends

This group comprises ten metavolcanic tools whose ends were used in an active diffused percussive mode. A few specimens carry additional use wear on the ends or other parts of their body (Table 10.7).

The tools discussed in this section were made with raw materials and techniques similar to those used for cutting edge tools (see above). They were also made in sizes and plans similar to those cutting edge tools I defined as large. The above similarities may create the impression that these implements represent recycled cutting edge tools. Yet, as I show below, other characteristics suggest that they make up a different functional type and never served as cutting edge tools. I should emphasise, nevertheless, that a few of the Alepotrypa cutting edge tools were indeed recycled to serve active diffused percussive functions with their ends (see above). I should also note that the tools discussed here are reminiscent of the Franchthi Cave macrolithics I published under the name ‘active tools used with the ends’ (Stroulia 2010, 94–98).

All items in this group have a known provenience. More than half ($n = 6$) come from Chamber B (all found in B/1). Three specimens derive from Chamber D, one from Chamber A. None was found in Chambers Z and L. Four tools (40%) were excavated in areas with primary/secondary burials or of probable non-utilitarian functions: LN/FN female burial of B/1, Ossuary II, and D/12. Secure

Table 10.7. Metavolcanic tools used in an active diffused percussive mode with the ends

Name	Prov	Date	Material	Pres	L	W	T
D118	B/1/29	LN/FN	metavolcanic	c	5.4	3.9	3.7
D365	D/9/145a	FN	metavolcanic	c	5.5	4.0	2.9
D116	B/1/50	LN	metavolcanic	c	6.2	4.6	3.8
D364	D/12/158	FN	metavolcanic	c	6.4	5.2	4.5
D159	B/1/2/65	LN	metavolcanic	c	6.7	4.5	3.8
D363	D/12/152	FN	metavolcanic	c	7.3	5.8	3.9
D418	B/1/35	LN/FN	metavolcanic	c	7.9	4.1	3.5
D123	B/1/51	LN	metavolcanic	c	8.3	4.0	3.3
D115	B/1/53	LN	metavolcanic	c	8.6	4.8	4.1
D108	A/2/6	EN?	metavolcanic	f	4.4	4.2	4.0

or probable dates are available for all specimens in this group. Their distribution is as follows: EN:1, LN:4, LN/FN:2, FN:3.

With the exception of D108, all the tools are complete. The scarcity of fragments implies that the percussive uses were not violent enough to regularly expose these tools to the risk of fracture. The nine complete items range in length from 5.4 to 8.6 cm ($\bar{x} = 6.9$ cm). Two specimens are shorter than 6 cm and thus hard to use with the ends. They may be at an exhausted state.

The complete items range from 3.9 cm to 5.8 cm in width and from 2.9 cm to 4.5 cm in thickness. Their average width and thickness are 4.5 cm and 3.7 cm respectively and thus greater than those of the complete cutting edge tools that I classified as large (width: 4.0 cm, thickness: 2.7 cm). These comparisons suggest that the tools used in a diffused percussive mode with the ends are generally more massive than large cutting edge tools. As such they do not represent recycled large cutting edge tools. This hypothesis is reinforced by the fact that almost all the specimens used in a diffused percussive mode with the ends have their maximum thickness at one of the ends – a characteristic not encountered among large cutting edge tools.

With the exception of possibly *a posteriori* D365 and D418, the specimens in this group underwent a process of manufacture. This process involved more or less systematic grinding of cobbles and, in several cases, prior pecking as well. It produced relatively smooth body surfaces and shapes characterised by a tapering thickness (and sometimes width) from one end to the other, *e.g.*, D116 (Figure 10.18) and D159 (Figure 10.19). The ends intended for diffused percussive use probably remained unground (and unpecked). Body grinding/pecking, nevertheless, determined their size and contour and this, I believe, was its main purpose. More specifically, through the grinding/pecking of the body, one end was given a roughly circular or elliptical shape, the other was given a roughly ovate or elongated shape, *e.g.*, D159 (Figure 10.19) and D364. In some cases, both ends acquired a similar circular, elliptical, or ovate contour but different dimensions: one was made larger than the other, *e.g.*, D116 (Figure 10.18). It appears that it was important



Figure 10.18. Face and ends of D116 (metavolcanic tool used percussively at the ends) (photos by the author).

for the users to have two ends of different sizes or shapes available simultaneously.

Both ends of all complete tools were used. For the most part, the ends have a rough regular or irregular texture, the result of active diffused percussion. All but one of the ends are generally convex, *e.g.*, D118. The exception is the larger end of D159 (Figure 10.19), which is (probably naturally) lightly concave. A few of the ends, moreover, show subtle ridges, *e.g.*, D116 (Figure 10.18). The general convexity of the ends suggests use in conjunction with passive implements containing a cavity, whereas the ridges found in certain ends indicate an angled (or combined perpendicular and oblique) use of the active tool. Judging from the relative shortness of the specimens in this group, the cavity of the associated passive implements could have been neither deep nor narrow. Otherwise, the user's fingers would have been injured. The material of the passive implements consisted of stone; or so is indicated by scars at the periphery of some of the active tools' ends, *e.g.*, D364. A few of the cavity tools discussed above may represent the passive implements in question. In no case, however, were specimens of the two tool types found in physical association with each other.

The tools used in an active diffused percussive mode with the ends and their passive counterparts may have



Figure 10.19. Face, profile, and end of D159 (metavolcanic tool used percussively at the ends) (photos by the author).

served to process (pulverise?) certain substances. What these substances consisted of is unknown, but spices, condiments, salt, herbs, or incense are possible candidates.

Most items ($n = 6$) in this group were reused or recycled as evidenced by additional use wear on the ends and/or body. For example, both ends of D116 (Figure 10.18) are roughly circular. They were originally used in an active diffused percussive mode with a passive cavity tool and acquired a convex shape of irregular texture as a result. At some point, however, the convex shape of the larger end was interrupted in the centre by an anomalous area, the result of a secondary active diffused percussion that was more violent and more localised than the primary one. The secondary use does not appear to have taken place in conjunction with a passive cavity tool. Interestingly, this specimen also carries percussion marks on its ground body from occasional use as a hammer. In one case – D108 (illustrated in Papathanassopoulos 2011, 102) – recycling involved a passive abrasive use. This fragmentary tool is crossed longitudinally by a narrow, well smoothed, U-section groove with a pointed end. The groove is itself fragmentary measuring 3.9 cm in length, 1.0 cm in maximum width, and 0.3 cm in maximum depth. It was probably formed *a posteriori* through grinding and/or polishing pointed wooden or bone implements. A similar groove is found in one of the schist specimens discussed above.

Small conical tools with a variety of active use wear

This group comprises five small metavolcanic tools of a roughly conical shape (Table 10.8). I use the term 'base'

Table 10.8. Small metavolcanics conical tools with a variety of active use wear

Name	Prov	Date	Material	Pres	L	W	T
D117	B/1/52	LN	metavolcanic	c	4.0	3.0	2.9
B/1/299[1]	B/1/299	LN	metavolcanic	c	4.5	3.1	3.0
D1195	B/1, back-dirt from female burial	LN/FN	metavolcanic	c	5.1	4.6	4.0
D119	B/1/51	LN	metavolcanic	c	5.2	4.3	3.9
D120	B/1a/17	FN	metavolcanic	f	4.4	2.9	2.6

to refer to the large end of the conical shape, the term ‘top’ to refer to the small end.

All specimens derive from trench B/1. One was recovered in back-dirt from the LN/FN female burial of B/1. Dates are available for all items. They are distributed as follows: LN:3, LN/FN:1, FN:1.

Four tools are complete, one is fragmentary. The complete ones range from 4.0 cm to 5.2 cm in length, from 3.0 cm to 4.6 cm in width, and from 2.9 cm to 4.0 cm in thickness. All have a naturally lopsided base.

No specimen carries evidence of manufacture. All consist of water-rolled pebbles used *a posteriori*. If so, I assume that a certain amount of effort was invested in the search of small roughly conical pebbles with a lopsided base.

All use wear is active and found on the top, the base, or both. The roughly circular convex tops of all but one specimen were used. Those of complete D117 (illustrated in Papathanassopoulos 2011, 101) and fragmentary D120 were used in a diffused percussive mode. Those of D119 (Figure 10.20) and B/1/299[1] were lightly used in a diffused abrasive or percussive mode.

D119 (Figure 10.20), one of the specimens with a utilised top, shows use wear on its lopsided base as well. The base is generally flat but with anomalies. It may have been used in a combined diffused percussive and abrasive mode (in a crushing manner) for processing a certain substance on a relatively flat passive surface. The small size of this specimen (it is the largest in the group, however) leaves little doubt of the limited amount of material processed at any one time. The material processed has nothing to do with the white crust embedded on the base; this crust is post-depositional (Karkanas, pers. comm.).

Finally, one tool – D1195 – was used only on the base. In this case, a relatively flat lopsided base was lightly used in a percussive mode or in a mode that combined percussion and abrasion.

The functions of the tools of this group are unclear. Given their small size, nevertheless, I assume that they were used in the context of fine tasks.

Metavolcanic miscellanea

This group is heterogeneous. It comprises six metavolcanic tools that do not fit the three roughly homogeneous groups discussed previously (Table 10.9).

Four items have a known provenience. Two come from Chamber B, the other two from Chamber D. Two



Figure 10.20. Small conical metavolcanic tool D119: face (middle) and ends (photos by the author).

specimens derive from probable non-utilitarian contexts: D/12; and back-dirt from D/9, D/10 (both make up Ossuary II), D/11, and D/12. Dates are available for all four items with a known provenience. Three are dated to FN, one to LN.

All tools are complete. They range from 4.2 cm to 7.8 cm in length, from 4.0 cm to 7.0 cm in width, and from 1.8 cm to 5.9 cm in thickness. All, moreover, consist of water-rolled pebbles/cobbles used *a posteriori*. Four of them were used exclusively in an active diffused abrasive mode. D416, D682, and D883P consist of cobbles that were used with various degrees of intensity and altered in shape and/or texture accordingly. The fourth specimen – D419a – is a small thin flattish pebble. It has a very smooth surface that reflects light and is crossed by striae – the result of abrasive use on a material that was not particularly hard. This tool appears most intensively used on one side and one end. Both are lightly convex

Table 10.9. Metavolcanic miscellanea

Name	Prov	Date	Material	Pres	L	W	T
D883P	n/a	n/a	metavolcanic	c	4.2	5.0	4.5
D128	B/1/53	LN	metavolcanic	c	4.5	4.2	4.2
D416	D/9, D/10, D/11, and D/12 back-dirt	FN	metavolcanic	c	5.3	4.8	4.1
D419a	B/1/24	FN	metavolcanic	c	5.4	3.5	1.8
D682	back-dirt	n/a	metavolcanic	c	6.5	4.0	3.3
D429	D/12/162	FN	metavolcanic	c	7.8	7.0	5.9

and were used on a concave surface. D419a likely functioned as a pot burnisher. A limestone/marble tool also interpreted as a pot burnisher is discussed below. A small number of possible pot burnishers have been noted in several other Aegean Neolithic sites: Kitsos Cave (Perlès 1981), Franchthi Cave (Stroulia 2010, 115–116), Sesklo and Dimini (Moundrèa-Agrafioti 1981, 255–262), Achilleion (Winn and Shimabuku 1989), Servia (Mould *et al.* 2000), Lerna (Banks 2015, 206), Iliotopos (Hadou 2011), Stravroupoli (Alisøy 2002), Avgi (Bekiaris 2012), Agios Petros (Efstratiou 1985, 46), Kremasti-Kilada (Chondrou 2010, 115–116; Dubreuil *et al.* in prep.), and Makri (pers. observ.). The hypothesis of a pot burnishing function has been tested (and supported) by combined use wear analysis and experimental work only for the Kremasti-Kilada specimens (Dubreuil *et al.* in prep.). The general scarcity of such tools compared to the enormous quantity of burnished pots seems to suggest that in the Neolithic Aegean most pot burnishers were of materials other than stone (see also Moundrèa-Agrafioti 1981, 256).

Nearly spherical D128 carries percussion marks all over its surface and was used exclusively in a percussive mode. The spherical shape appears to be the result of intensive use. This use perhaps consisted of pecking the surfaces of other objects (*e.g.*, the open abrasive tools discussed above) in the context of manufacture and/or resharpening. D128 is small enough to be considered exhausted. Several roughly spherical percussive tools have been reported from Sitagroi (Elster 2003a), Franchthi Cave (Stroulia 2010, 101–105), and Kremasti-Kilada (Chondrou 2010, 126).

Finally, D429 carries both percussive and abrasive wear. Two portions of the cobble were used in a percussive mode; one intensively enough to evolve into an irregular flattish face on which the tool can rest, the other much less intensively. Two other portions were used abrasively.

Limestone/marble

Water-rolled cobbles/pebbles with limestone characteristics, marble characteristics, and a combination of limestone and marble characteristics were used for the majority of the Alepotrypa macrolithics (131 specimens or 45%). For this continuum that starts with limestone and ends with marble I have used the term ‘limestone/marble’. Cobbles/pebbles with limestone characteristics were probably

collected at Diros Bay. Those with marble characteristics or a combination of limestone and marble characteristics were probably obtained at the Bay of Neo Itilo immediately north of Diros Bay. A number of specimens have lost their original smooth texture and white/tan colour, currently exhibiting a rough red/brown surface. This surface alteration is the result of post-depositional processes that took place in the damp environment of the cave (Karkanas, pers. comm.). The excavations recovered numerous limestone/marble pebbles/cobbles. My study includes only those carrying more or less clear evidence of use.

The dated limestone/marble specimens exhibit a relatively even distribution among EN, LN, and FN – the three main phases represented at the site.

Limestone/marble was used for two main groups: 1. *A posteriori* tools; 2. *Non-a posteriori* tools.

A posteriori tools

There are 80 *a posteriori* limestone/marble tools. They were not subjected to a manufacturing process. The raw material was put directly to use without prior modification. On the basis of use wear, I divided these specimens into four subgroups: 1. *A posteriori* tools with exclusive abrasive wear; 2. *A posteriori* tools with exclusive percussive wear; 3. *A posteriori* tools with both abrasive and percussive wear; 4. *A posteriori* miscellanea.

A posteriori tools with exclusive abrasive wear

This subgroup comprises 27 limestone/marble specimens (Table 10.10). Twenty-four of them have a known provenience. Fifteen were excavated in Chamber B (all in B/1). The remaining nine were found in chambers A (n = 3), Z (n = 3), and L (n = 3). None was recovered in Chamber D. Eight items (or 33% of those with a known provenience) derive from areas with primary/secondary burials or of non-utilitarian functions: LN/FN female burial of B/1, Ossuary I, Z/22, and Chamber L. Secure or probable dates are available for all 24 items with a known provenience. Twenty-one are distributed as follows: EN:3, LN:9, LN/FN:1, FN:8. The remaining three (all from Z/22) are generally attributed to EN-FN.

Twenty-four tools are complete, three are fragmentary. The complete ones range from 4.6 to 14.8 cm in length ($\bar{x}$ = 8.8 cm), from 2.4 to 8.5 cm in width ($\bar{x}$ = 5.5 cm), and from 2.0 to 5.6 cm in thickness ($\bar{x}$ = 3.7 cm). Most specimens are relatively small and could thus affect only

Table 10.10. Limestone/marble a posteriori tools with exclusive abrasive wear

Name	Prov	Date	Material	Pres	L	W	T	L/W
B/1/370[2]	B/1/370	LN	lime/marble	c	4.6	4.2	2.4	1.09
B/1/774	B/1/774	LN	lime/marble	c	5.5	4.2	2.9	1.30
B/1/466[2]	B/1/466	LN	lime/marble	c	5.7	5.5	4.2	1.03
D411a	B/1/51	LN	lime/marble	c	5.9	2.4	2.0	2.45
B/1/81[3]	B/1/81	LN	lime/marble	c	6.1	4.3	2.6	1.41
B/1/25[6]	B/1/25	FN	lime/marble	c	6.3	5.4	2.9	1.16
B/1/480	B/1/480	LN	lime/marble	c	6.5	5.9	3.7	1.10
B/1/24[2]	B/1/24	FN	lime/marble	c	7.3	6.6	4.1	1.10
B/1/25[5]	B/1/25	FN	lime/marble	c	7.6	2.5	2.4	3.04
B/1/85	B/1/85	LN	lime/marble	c	7.6	6.0	4.4	1.26
D488	Z/22/148	EN-FN	lime/marble	c	7.8	4.1	3.8	1.90
Z/22/488	Z/22/488, T.148	EN-FN	lime/marble	c	7.8	4.1	3.9	1.90
52AL	n/a	n/a	lime/marble	c	8.3	7.2	4.9	1.15
B/1/25[3]	B/1/25	FN	lime/marble	c	9.3	8.5	4.2	1.09
Z/22/718	Z/22/718, T.334	EN-FN	lime/marble	c	9.7	4.7	2.7	2.06
LA1	LA1	FN	lime/marble	c	9.8	3.7	3.6	2.64
56AL	n/a	n/a	lime/marble	c	10.2	7.5	4.8	1.36
A/4[4]	A/4	EN?	lime/marble	c	10.4	6.0	3.8	1.73
LA1/216-18	LA1/216-18	FN	lime/marble	c	10.7	5.8	3.3	1.84
B/1/34[3]	B/1/34	LN/FN	lime/marble	c	11.2	7.2	5.2	1.55
A/1/5[1]	A/1/5	EN?	lime/marble	c	11.4	6.6	5.6	1.72
B/1/25[8]	B/1/25	FN	lime/marble	c	11.7	8.0	4.4	1.46
33AL	n/a	n/a	lime/marble	c	14.5	6.0	4.3	2.41
LA1/216-17	LA1/216-17	FN	lime/marble	c	14.8	5.6	3.7	2.64
B/1/500[1]	B/1/500	LN	lime/marble	f	3.6	3.1	2.4	n/ap
B/1/444[3]	B/1/444	LN	lime/marble	f	5.3	4.3	2.5	n/ap
A/1/4[2]*	A/1/4	EN?	lime/marble	f	7.6	10.9	5.5	n/ap

small surfaces at any one time during use. Interestingly, these tools do not appear exhausted. Their small size must have been suitable for the purposes they were meant to serve.

Two main shapes are represented in this subgroup. Fourteen of the complete specimens are circular to elliptical in plan and have a length/width ratio of no more than 1.50. The remaining ten have a more elongated form with a higher length/width ratio (1.70–3.00). Regardless of shape, use wear is most often found on the faces. Circular/elliptical and elongated tools, however, were employed in ways that produced different use wear configurations.

The abrasive wear of the circular/elliptical tools is active unless otherwise noted. For the most part, it is found on only one face. In certain specimens, the abrasive use was rigorous enough to flatten a naturally convex face, *e.g.*, B/1/25[6] (Figure 10.21). In others, it was not intensive enough to cause a substantial alteration of the whole face. In these cases, only the highest portion of a naturally convex face was flattened (*e.g.*, 56AL) or a facet was formed on the periphery of a face (*e.g.*, B/1/480). The abrasive wear of two tools consists of a concave area: In B/1/24[2], the central portion of a naturally flattish face is slightly concave probably as a result of passive use in conjunction with a convex active surface. In B/1/25[3], a naturally lightly convex face is interrupted by a lightly concave area extending from the face's centre to the periphery. The concave area is the result of an active angled use of the face in conjunction with a convex passive surface.



Figure 10.21. Face (right) and profile of B/1/25[6] (limestone/marble a posteriori tool with exclusive abrasive wear) (photos by the author).

Finally, four circular/elliptical tools carry abrasive wear on both faces. The faces were not always used with the same intensity. B/1/85, for example, has one flattened face and a second with only a subtle facet.

If a concave portion is the exception for circular/elliptical tools, it is the rule for elongated ones. This pattern indicates that circular/elliptical and elongated water-rolled pebbles/cobbles were picked

not at random, but rather systematically, to be used in specific manners.

A concave area is found on seven of the ten complete elongated tools. The general morphology and size of these specimens as well as the location of the concave area suggest a use in an active mode. Almost all carry a single concave area. It is found on one of the faces. The concave area was produced as the user moved the face reciprocally and against its long axis over a convex passive surface. Certain specimens were lightly used. In 33AL, for example, only a portion of a naturally convex face became lightly concave. Others were used much more intensively. In Z/22/718 and A/4[4] (Figure 10.22), for example, the whole face or a substantial portion of it became concave. A/4[4], in fact, carries additional wear: its other, naturally convex, face was subtly flattened as a result of a brief abrasive use in conjunction with a flat passive surface.

One elongated specimen – LA1 – carries two concave parts. This tool has three faces and a roughly subtriangular section. The largest of the faces is concave as a result of intensive active use. A portion of another is also concave from an active use that was localised. Other parts of the tool are naturally convex but smoother than their surroundings as a result of short active use episodes.

Finally, three elongated specimens – D411a, D488, and B/1/34[3] – lack a concave configuration. D411a is the most interesting. This specimen is unusual, since its whole body is extremely smooth. Yet, it was used basically on one side. This side is flattened carrying

fine parallel stries perpendicularly to its long axis. This use wear may have developed in the context of pot burnishing. A metavolcanic specimen interpreted as a pot burnisher is discussed above.

Circular/elliptical and elongated specimens are morphologically different. I believe, however, that their commonalities are more important than their differences and point to uses in the context of similar tasks. Both kinds of tools are generally small and could only affect limited surfaces at any one time during use. Moreover, both have used areas whose boundaries are generally gentle, not sharp, an indication that they were not used on a hard material (*i.e.*, stone). One specimen appears to have been used to burnish clay vessels. The rest may have been used for burnishing small wooden surfaces (see Julien 1985, 212) or softening/polishing small pieces of animal skin (see Cristiani *et al.* 2012; de Beaune 1989b; González and Ibáñez 2002; Phillipson 2001; Starnini and Voytek 1997). The Alepotrypa people may have used tools of two different forms to treat surfaces of two different shapes. Circular/elliptical tools could have been useful for burnishing flat wooden surfaces or softening/polishing pieces of hide placed on hard, flat surfaces. Elongated tools, on the other hand, could have been preferred for burnishing narrow convex wooden surfaces (*e.g.*, parts of a figurine or a handle) or pieces of hide placed on hard, convex, narrow surfaces. These tools lack the polished surfaces associated with wood burnishing or hide softening/polishing. This may be the result of post-depositional processes.

A posteriori tools with exclusive percussive wear

This subgroup includes 28 limestone/marble specimens (Table 10.11). Twenty of them have a known provenience. They were excavated in two chambers: A ($n = 6$) and B ($n = 14$, 13 from B/1). No specimens were recovered in Chambers D, Z, and L. Three come from the LN/FN female burial of B/1 and Ossuary I. Secure or probable dates are available for all 20 items with a known provenience. They are distributed as follows: EN:6, MN/LN:1, LN:5, LN/FN:3, FN:5.

Twenty-five tools are complete. Three are fragmentary. The scarcity of fragments implies that the percussive uses of these tools were not violent enough to regularly expose them to the risk of fracture. The complete specimens range from 5.0 to 17.3 cm in length ($\bar{x} = 11.0$ cm), from 2.7 to 10.2 cm in width ($\bar{x} = 6.1$ cm), and from 2.5 to 7.3 cm in thickness ($\bar{x} = 4.5$ cm). A comparison between the dimensions of *a posteriori* limestone/marble tools with exclusive abrasive wear (discussed earlier) and those with exclusive percussive wear reveals that, as a rule, the latter are somewhat larger than the former. It seems that more massive cobbles/pebbles were selected for tools intended for percussive than for abrasive tasks. The width/length ratio of the complete specimens ranges from 1.07 to 3.26 (1.86). The majority have an elongated plan.



Figure 10.22. Face (right) and profile of A/4[4] (limestone/marble *a posteriori* tool with exclusive abrasive wear) (photos by the author).

Table 10.11. Limestone/marble a posteriori tools with exclusive percussive wear

Name	Prov	Date	Material	Pres	L	W	T	L/W
B/1/2/65[1]	B/1/2/65	LN	lime/marble	c	5.0	4.2	4.1	1.19
B/2/122	B/2/122	FN?	lime/marble	c	5.0	4.6	4.5	1.09
B/1/430[2]	B/1/430	LN	lime/marble	c	5.7	2.7	1.5	2.10
A/2[3]	A/2	EN?	lime/marble	c	6.1	2.9	2.5	2.00
B/1a/15	B/1a/15	FN	lime/marble	c	6.4	4.7	2.5	1.36
44AL	n/a	n/a	lime/marble	c	6.4	6.0	5.2	1.07
B/1/30[2]	B/1/30	LN/FN	lime/marble	c	9.1	6.2	3.0	1.46
A/4[3]	A/4	EN?	lime/marble	c	10.1	5.1	4.6	1.98
D744	B/1a/17	FN	lime/marble	c	10.2	6.2	3.1	1.64
B/1/29	B/1/29	LN/FN	lime/marble	c	10.3	3.5	3.2	2.94
B/1/529[3]	B/1/529	MN/LN	lime/marble	c	10.5	9.8	3.6	1.07
61AL-P	n/a	n/a	lime/marble	c	10.8	3.8	2.7	2.84
34AL	n/a	n/a	lime/marble	c	11.1	5.8	3.9	1.91
A/4[5]	A/4	EN?	lime/marble	c	11.4	8.0	7.3	1.42
A/1/4[1]	A/1/4	EN?	lime/marble	c	11.6	4.3	3.5	2.69
B/1/23[1]	B/1/23	FN	lime/marble	c	11.6	7.0	5.7	1.65
D191[1]	B/1/35	LN/FN	lime/marble	c	12.0	4.8	3.4	2.50
40AL	n/a	n/a	lime/marble	c	12.3	8.7	6.3	1.41
A/2[6]	A/2	EN?	lime/marble	c	12.8	9.3	6.2	1.37
49AL	n/a	n/a	lime/marble	c	12.8	8.0	6.3	1.60
B/1/220	B/1/220	LN	lime/marble	c	12.9	7.3	6.4	1.76
B/1/299[3]	B/1/299	LN	lime/marble	c	13.6	10.2	7.1	1.33
A/2[2]	A/2	EN?	lime/marble	c	15.2	6.4	5.3	2.37
41AL	n/a	n/a	lime/marble	c	16.4	6.5	5.1	2.52
43AL	n/a	n/a	lime/marble	c	17.3	5.3	4.8	3.26
35AL*	n/a	n/a	lime/marble	f	5.7	9.2	7.0	n/ap
B/1/27[1]	B/1/27	FN	lime/marble	f	8.1	4.3	3.9	n/ap
B/1/329	B/1/329	LN	lime/marble	f	8.1	4.9	2.9	n/ap

All percussive wear is active. With three exceptions, percussive wear is found on one or both ends. This wear is quite diverse, probably reflecting different tasks, processed materials, and degrees of use intensity. I offer a glimpse of this variation below.

Most tools with end wear were used in a perpendicular mode. Some were used more substantially than others. For example, A/2[3] is a small specimen with percussive wear on only one end. B/1/2/65[1] (Figure 10.23) is also small, but carries such wear on both ends. The size of both tools indicates use for fine tasks – possibly in the context of lithic manufacture/maintenance (see Kourtesi-Philippakis, this volume). A/4[3] is much more massive than the above specimens. Yet, it was used expediently as it carries limited wear only on the top of one of its naturally convex ends. 34AL is comparable in size to A/4[3]. It carries percussive wear on both ends, but was used expediently too. Both tools could have been used more extensively/intensively, but were not. A/4[5] (Figure 10.24) is even larger. Both ends were used. One was more or less flattened by use, the other was used much less substantially. Other tools, such as massive B/1/220 and A/2[2], were heavily used on both ends.

The ends of five tools appear to have been used in an angled, not perpendicular, manner. These specimens



Figure 10.23. Face (middle) and ends of B/1/2/65[1] (limestone/marble a posteriori tool with exclusive percussive wear) (photos by the author).



Figure 10.24. Face (middle) and ends of A/4[5] (limestone/marble *a posteriori* tool with exclusive percussive wear) (photos by the author).

are oblong with a length/width ratio higher than 2.50. A/1/4[1], B/1/29, 43AL, and 61AL-P were used with only one end, D191[1] was used with both. In all cases, percussion was unifacial.

Finally, three tools deviate from the general rule of use with the ends. The first – 35AL – represents approximately half of a large thick ovate tool. It shows continuous percussive wear on the preserved end and the two sides. The other two tools – 44AL and B/2/122 – have a roughly spherical shape. Since they carry use wear on several, but not all, portions of their body, it can be assumed that the spherical shape roughly represents the natural form of the pebble/cobble that served as raw material. *A posteriori* limestone percussive tools of globular shape have been identified at Drakaina Cave (Bekiaris forthcoming).

A posteriori tools with both abrasive and percussive wear

This subgroup comprises 24 limestone/marble specimens (Table 10.12). All represent cases of recycling. In most (if not all) of them, the percussive use followed the abrasive one; or so is indicated by the larger extent

of the abrasive wear compared to the percussive one and/or the interruption of abrasively used surfaces by percussive wear.

Twenty-one items have a known provenience. Fifteen were found in Chamber B (all in B/1), five in Chamber A, and one in Chamber D. None was recovered in Chambers Z and L. Seven items (33% of those with a known provenience) were excavated in the LN/FN female burial of B/1, Ossuary I, and Ossuary II. Secure or probable dates are available for 20 specimens. They are distributed as follows: EN:5, LN:5, LN/FN:1, FN:9.

Eighteen tools are complete, six are fragmentary. The complete ones range from 6.8 to 15.2 cm in length ($\bar{x}$ = 11.9 cm), from 5.0 to 13.3 cm in width ($\bar{x}$ = 8.6 cm), and from 3.0 to 6.8 cm in thickness ($\bar{x}$ = 5.1 cm). A comparison between the dimensions of *a posteriori* tools with exclusive abrasive wear (discussed earlier) and those carrying both abrasive and percussive wear suggests that the latter are generally much larger than the former. It further suggests that only the largest of the available abrasively used tools were selected for additional percussive uses. The length/ width ratio of the complete items ranges from 1.03 to 2.01 ($\bar{x}$ = 1.43). The majority have an elliptical plan.

All abrasive wear is active and appears only on the faces. Being larger, the faces of these tools affected larger surfaces during their abrasive use than the faces of the aforementioned smaller tools carrying exclusive abrasive wear. Percussive wear is evident mostly on the ends, more rarely on the sides, periphery,³ or faces. With a few exceptions, all percussive wear is active.

Abrasive and percussive wear are combined on these tools in various ways. There is also a large variety regarding the number of use episodes and the intensity of use. I present here a sample of this variation.

Certain specimens show abrasive wear on one face and percussive wear on one end. One example is B/1/25[7]: it was abrasively used on one face in a way that made it flatter than the other and was briefly used percussively as evidenced by limited battering on the very top of one of its naturally convex ends. Another example is A/4[6] (Figure 10.25): light angled abrasive use of one face created a gentle facet, whereas a relatively substantial perpendicular percussive use flattened one end. Other specimens show abrasive wear on one face and percussive wear on both ends, e.g., A/4/470[1]. One specimen – B/1[2] – was used abrasively on one face and percussively on both ends and one of the sides, while another specimen – A/4[7] – was used abrasively with both faces and percussively with its periphery. In yet another variation, seen in A/4/470[2], abrasive and percussive wear appear on the same face: gently flattened by active abrasive use, this face shows percussive wear in the centre from a secondary, likely passive, localized use. A couple of specimens had even more complex use lives. A/4/457 is one of them. After

Table 10.12. Limestone/marble *a posteriori* tools with both abrasive and percussive wear

Name	Prov	Date	Material	Pres	L	W	T	L/W
B/1/18	B/1/18	FN	lime/marble	c	6.8	5.0	3.0	1.36
B/1/39[1]	B/1/39	LN/FN	lime/marble	c	9.8	5.0	4.1	1.96
B/1/27[2]	B/1/27	FN	lime/marble	c	9.9	8.3	4.4	1.19
B/1/23[2]	B/1/23	FN	lime/marble	c	10.3	8.3	4.7	1.24
B/1/2/65[2]	B/1/2/65	LN	lime/marble	c	10.9	5.4	4.6	2.01
A/4/457	A/4/457	EN	lime/marble	c	11.5	8.9	5.6	1.29
A/4/470[2]	A/4/470	EN	lime/marble	c	11.6	9.6	5.5	1.20
A/4/470[1]	A/4/470	EN	lime/marble	c	12.3	8.3	6.0	1.48
B/1/25[1]	B/1/25	FN	lime/marble	c	12.3	10.3	5.2	1.19
A/4[6]	A/4	EN?	lime/marble	c	12.4	8.0	6.5	1.55
B/1/25[2]	B/1/25	FN	lime/marble	c	12.6	9.5	4.5	1.32
B/1/25[7]	B/1/25	FN	lime/marble	c	12.7	7.5	5.5	1.69
37AL-P	n/a	n/a	lime/marble	c	12.8	8.8	5.4	1.45
A/4[7]	A/4	EN?	lime/marble	c	12.9	10.5	6.4	1.22
B/1a/16	B/1a/16	FN	lime/marble	c	13.2	8.4	5.9	1.57
B/1[2]	B/1	n/a	lime/marble	c	13.2	6.6	4.4	2.0
B/1/24[1]	B/1/24	FN	lime/marble	c	13.8	13.3	4.2	1.03
B/1/82[2]	B/1/82	LN	lime/marble	c	15.2	13.2	6.8	1.15
D/9-10/240	D/9-10/240	FN	lime/marble	f	5.8	4.5	4.1	n/ap
B/1/370[1]*	B/1/370	LN	lime/marble	f	8.1	10.7	5.2	n/ap
B/1/549	B/1/549	LN	lime/marble	f	10.8	6.9	3.5	n/ap
36AL	n/a	n/a	lime/marble	f	11.9	7.0	5.1	n/ap
53AL	n/a	n/a	lime/marble	f	12.4	10.5	3.4	n/ap
B/1/398[1]	B/1/398	LN	lime/marble	f	13.2	7.8	4.3	n/ap



Figure 10.25. Face (bottom) and used end of A/4[6] (limestone/marble *a posteriori* tool with both abrasive and percussive wear) (photos by the author).

being flattened by intensive active abrasive use, one of its faces was used in an active percussive mode, as evidenced by battering found all over its surface. The other face was also used percussively but only in its central area. One of the ends was used percussively as well.

The diverse abrasive and percussive wear exhibited by these tools leaves little doubt that they were involved in a variety of tasks and served a variety of purposes. It also reinforces the impression of a flexible and practical attitude on the part of the Alepotrypa people towards their tools and their uses (see above). What exactly these tasks were and how many individuals used each tool is not clear, however.

A posteriori limestone/marble miscellanea

This subgroup consists of a single specimen that could not be included in the three roughly homogeneous *a posteriori* limestone/marble discussed above. 57AL is a large complete water-rolled cobble of a somewhat subtriangular plan and subrectangular section. Each of its two opposite faces is naturally lightly convex but contains a shallow central area covered with cutting marks. Both faces appear to have served as cutting boards (Table 10.13).

Non-a posteriori tools

Unlike the limestone/marble pebbles/cobbles discussed above, which were put directly to use without prior modification, those used for *non-a posteriori* tools were treated in specific ways to produce specific forms. There

Table 10.13. *A posteriori* limestone/marble miscellanea

Name	Prov	Date	Material	Pres	L	W	T
57AL	n/a	n/a	lime/marble	c	24.0	15.5	6.7

Table 10.14. *Limestone/marble non-a posteriori* tools manufactured by grinding or chipping listed in four categories

Name	Prov	Date	Material	Pres	L	W	T
48AL	n/a	n/a	lime/marble	c	6.1	4.2	3.2
A/2/6[1]	A/2/6	EN?	lime/marble	c	6.2	3.7	2.3
50AL	n/a	n/a	lime/marble	c	7.3	4.0	1.8
A/1/5[2]	A/1/5	EN?	lime/marble	c	5.2	3	1.7
A/2[1]	A/2	EN?	lime/marble	c	6.3	2.6	2.0
A/3a/425[1]	A/3a/425	EN	lime/marble	c	8.2	5.7	2.5
A/4[9]	A/4	EN?	lime/marble	c	8.8	4.9	4.6
A/2/6[3]	A/2/6	EN?	lime/marble	c	9.5	7.9	3.7
A/2[4]	A/2	EN?	lime/marble	c	12.9	8.6	4.7
51AL	n/a	n/a	lime/marble	f	6.5	5.8	3.3
A/2/6[2]	A/2/6	EN?	lime/marble	c	9.3	8.3	3.8
B/6/119[1]	B/6/119	FN?	lime/marble	c	10.3	3.4	1.9
D17147	B/1H/371	LN	lime/marble	c	4.1	2.5	2.1
B/1/22	B/1/22	FN	lime/marble	c	6.2	3.0	2.3
47AL	n/a	n/a	lime/marble	c	8.7	5.4	4.2

are 51 such specimens. I have divided them into three subgroups: 1. *Non-a posteriori* tools manufactured by grinding or chipping; 2. *Non-a posteriori* specimens produced by splitting; 3. *Non-a posteriori* miscellanea.

Non-a posteriori tools manufactured by grinding or chipping

This subgroup comprises 15 limestone/marble specimens (Table 10.14). The pebbles/cobbles that served as raw material were partially ground or chipped so as to create a working part that could serve a specific purpose. These tools should thus be considered as more or less specialised. The surfaces of all items have acquired a red/brown colour and rough texture as a result of post-depositional exposure to the damp cave conditions.

Eleven specimens have a known provenience. Eight derive from Chamber A, three from Chamber B. None comes from Chambers D, Z, and L. Two items were recovered in Ossuary I. Secure or probable dates are available for all 11 items with a known provenience. They are distributed as follows: EN:8, LN:1, FN:2. This distribution shows a clear concentration in EN.

Fourteen specimens are complete, one is fragmentary. Each specimen has a unique size and shape. Yet, the characteristics of their working parts and the processes by which they were formed allow their discussion in the context of four categories. Unless otherwise noted, all members of all categories were used actively.

The first category includes three specimens: A/2/6[1] (Figure 10.26), 48AL, and 50AL. All are small, ranging from 6.1 to 7.3 cm in length, from 3.7 to 4.2 cm in width,



Figure 10.26. Face (right) and profile of A/2/6[1] (limestone/marble non-a posteriori tool with a rounded point produced by grinding) (photos by the author).

and from 1.8 to 3.2 cm in thickness. Their working part consists of a rounded point formed on one end by purposefully grinding the body of a pebble/cobble. The rounded point may be suitable for pressure flaking.

The second category includes seven specimens: A/1/5[2], A/2[1], A/2[4], A/2/6[3], A/3a/425[1], A/4[9], and 51AL. They range from 5.2 cm to 12.9 cm in length, from 2.6 cm to 8.6 cm in width, and from 1.7 cm to 4.7 cm in thickness. The working part consists of an edge formed on one end by purposefully grinding the body of a pebble/cobble. The edge of 51AL is not limited to the end but continues onto one side as well, whereas A/2[4] has not one, but rather three edges. They were formed on the three tips of its triangular body.

The edge of A/3a/425[1] (Figure 10.27) is acute. It is also both lopsided and slightly curved in plan. This edge looks suitable for a transversal scraping use. The edges of the other six specimens are curved too, but thicker. The edges of all tools are damaged to a smaller or larger degree. Three tools – A/1/5[2], A/2[4], and A/2/6[3] – were additionally used on other parts of their body in an abrasive or percussive mode. A tool with an edge somewhat reminiscent to those of the specimens of this category was found in a possible pre-Neolithic deposit at the Franchthi Cave (Stroulia 2010, 23).

The third category includes two specimens: A/2/6[2] and B/6/119[1]. Like those of the two first categories, they have a working part on one end formed by grinding. Due to damage, however, it is unclear if this consisted of a rounded point or a thick edge.



Figure 10.27. Face (left) and profile of A/3a/425[1] (limestone/marble non-a posteriori tool with an edge produced by grinding) (photos by the author).

The fourth category includes D17147 (Figure 10.28), B/1/22, and possibly 47AL. They range from 4.1 to 8.7 cm in length, from 2.5 to 5.4 cm in width, and from 2.1 to 4.2 cm in thickness. The working part of D17147 and B/1/22 consists of a thick point produced on one end by the removal of a few small flakes. I am not certain that the thick point of 47AL is the result of manufacture; it may have been produced accidentally.

The Alepotrypa people probably employed all of the above tools in fine and precise tasks. Such tasks may, for example, have taken place in the context of lithic manufacture/maintenance or the production of shell blanks for ornaments and other artefacts (see Papathanassopoulos 2011, 217–219; Kourtessi-Philippakis, this volume; Theodoropoulou, this volume).

The near absence of *comparanda* from Aegean macrolithic assemblages reflects either a general absence of such tools from the Aegean prehistoric world or the superficial way in which many assemblages have been published.

Non-a posteriori specimens produced by splitting

This subgroup comprises 28 limestone/marble specimens (Table 10.15). Each consists of one piece of a split cobble. No joining pieces were found.

Twenty-one items have a known provenience. Fifteen were excavated in Chamber B (14 in B/1), five in Chamber A, and one in Chamber Z. None derives from Chambers D and L. Six (29% of those with a known provenience) were recovered in non-utilitarian contexts: Ossuary I and Z/22. Secure or probable dates are available for all 21 specimens with a known provenience. Twenty are distributed as follows: EN:5, MN/LN:3, LN:11, FN:1. One (found in



Figure 10.28. View of D17147 (limestone/marble non-a posteriori tool with an end produced by chipping) (photos by the author).

Z/22) is generally attributed to EN-FN. This distribution shows a concentration in the pre-FN phases.

These specimens range from 7.4 to 15.5 cm in length ($\bar{x}$ = 11.5 cm), from 4.1 to 14.4 cm in width ($\bar{x}$ = 8.8 cm), and from 1.6 to 8.1 cm in thickness ($\bar{x}$ = 3.5 cm). They were made from elliptical or ovate cobbles. Only one specimen – A/4/453 – was produced by a cobble's transversal splitting. In all other cases, the cobble was split longitudinally. It can thus be assumed that the current length roughly coincides with the length of the original complete cobbles. The length as well as the preserved width and thickness of these specimens indicate that the used cobbles in most cases were massive; in fact, more so than those used in all other limestone/marble tool subgroups. Large size, it seems, was a crucial factor in the procurement of raw material.

These specimens have a concave, convex, or flattish ventral face. In some cases, a cobble was split through the removal of a large flake, *e.g.*, D17652, B/1/275, and B/1/53[2]. In others, it may have been split by being forcefully thrown on a hard surface (Toth and Schick 2009) or through the bipolar technique with a hammer and anvil, *e.g.*, D17052. Given the presumed large size of the cobbles, the process of splitting must have required a certain degree of skill. Where splitting occurred is unknown. However, the fact that in no case were the two resulting pieces found suggests that, at some point after splitting, a certain manipulation occurred that involved their separation.

Use wear is generally limited and found on fewer than ten items. I doubt that the absence of use wear from the remaining specimens reflects the macroscopic level

Table 10.15. Limestone/marble non-a posteriori specimens produced by splitting

Name	Prov	Date	Material	Pres	L	W	T
Z/22/564	Z/22/564	EN-FN	lime/marble	c	7.4	7.0	1.6
A/4/453*	A/4/453	EN	lime/marble	c	7.4	10.7	8.1
B/1/269[1]	B/1/269	LN	lime/marble	c	7.9	5.5	1.6
B/1/53[1]	B/1/53	LN	lime/marble	c	8.7	7.3	2.4
A/3a/12	A/3a/12	EN?	lime/marble	c	8.9	4.1	2.4
B/1/271	B/1/271	LN	lime/marble	c	9.5	7.5	2.7
D17137	B/1D1/370	LN	lime/marble	c	9.5	7.1	2.3
46AL	n/a	n/a	lime/marble	c	9.5	5.7	3.7
D17052	B/1H/336	LN	lime/marble	c	10.2	9.5	2.4
A/4[8]	A/4	EN?	lime/marble	c	11.0	7.8	3.5
B/1/493	B/1/493	MN/LN	lime/marble	c	11.0	7.6	2.3
B/1/529[2]	B/1/529	MN/LN	lime/marble	c	11	8.4	2.5
B/1/275	B/1/275	LN	lime/marble	c	11.3	8.5	2.4
42AL	n/a	n/a	lime/marble	c	11.4	8.1	4.3
B/1/268[1]	B/1/268	LN	lime/marble	c	11.7	8.2	3.1
17654P	n/a	n/a	lime/marble	c	12.0	10.3	2.5
B/1/53[2]	B/1/53	LN	lime/marble	c	12.1	6.8	2.3
A/4[2]	A/4	EN?	lime/marble	c	12.7	6.5	3.5
39AL	n/a	n/a	lime/marble	c	12.8	10.0	4.7
45AL	n/a	n/a	lime/marble	c	12.9	12.1	3.5
38AL	n/a	n/a	lime/marble	c	13.1	9.4	5.4
B/5/101	B/5/101	FN?	lime/marble	c	13.2	10.7	2.9
B/1/398[2]	B/1/398	LN	lime/marble	c	13.3	10.5	4.1
A/4[1]	A/4	EN?	lime/marble	c	14.1	12.8	4.6
B/1/379[1]	B/1/379	LN	lime/marble	c	14.1	8.7	5.3
B/1/529[1]	B/1/529	MN/LN	lime/marble	c	14.1	8.6	2.6
B/1/768	B/1/768	LN	lime/marble	c	14.3	12.6	5.5
17652P	n/a	n/a	lime/marble	c	15.5	14.4	4.3

of examination or post-depositional surface alterations. I equally doubt that the unrecovered pieces were those selected for use, since it seems that cobbles were often broken in two roughly identical parts.

All identified use wear is active; most is found on these specimens' curvilinear edges. The clearest edge wear is found on four specimens: D17052, D17137, B/1/268[1] (Figure 10.29), and B/1/275[1]. One portion of the edge of B/1/275 is blunt. This bluntness could be the result of a transversal scraping use (that perhaps involved the interior of a large clay pot). This specimen could have been conveniently held with the opposite side. A portion of the edges of D17052, D17137, and B/1/268[1] (Figure 10.29), on the other hand, is more or less systematically notched and seems suitable for scraping animal skin (Parkinson, pers. comm.). D17052 carries, in addition, a few small scars on other portions of its edge. These scars, along with those seen on the edges of three other specimens – B/1/53[1], B/1/493, and B/1/271 – are the result of occasional percussive use.

In one specimen – 45AL – wear appears on a face, not an edge. This has an almost circular plan and a planoconvex section. Its ventral face is relatively flat and appears to have been used in an active abrasive mode. The alternative hypothesis that this face was flattened by grinding to create an object that could serve as a lid is not very convincing for two reasons: 1) the flattened face is not very regular; 2) this artefact does not match the form



Figure 10.29. Ventral face (left) and profile of B/1/268[1] (limestone/marble non-a posteriori specimen produced by splitting) (photos by the author).

of other Alepotrypa implements convincingly interpreted as lids (Papathanassopoulos 2011, 118–119). No use wear is found on the cortical faces of these specimens; these lack percussion marks, facets, or other features

that could be interpreted as the product of percussive or abrasive use.

The cobbles that served as raw material for the items discussed in this section have both limestone and marble characteristics; they were thus brought from outside Diros Bay (probably from the Bay of Neo Itilo north of Diros); they were not randomly selected; and, of course, they were processed systematically. A certain degree of effort was involved in all stages, which makes the limited evidence of use even more remarkable. With no parallels in published Aegean and other macrolithic assemblages, these objects are enigmatic and provoke a series of questions. Is it possible that splitting served non-utilitarian purposes? Were the resulting pieces involved in processes of enchainment, in the context of which they ended up with different individuals or groups and in different places (Chapman 2000; Chapman and Gaydarska 2007; see also Stroulia and Chondrou 2013)? Were these pieces never meant to be used? Could the limited evidence of use derive from a secondary treatment by individuals/groups not familiar with these objects' original function/s? For the moment, these questions remain unanswered.

Non-a posteriori limestone/marble miscellanea

This heterogeneous subgroup comprises eight non-*a posteriori* specimens (Table 10.16) that fit neither of the roughly homogeneous limestone/marble subgroups previously discussed.

Only three specimens have a known provenience. All were found in B/1. Two are dated to LN, one to FN.

D911P (Figure 10.30) and D683 represent respectively an almost intact and a fragmentary version of the perforated artefacts often referred to as maceheads. D911P has an almost perfect spherical shape, the result of grinding (perhaps after pecking) a water-rolled cobble. The diameter of the complete end of its shaft hole is 1.5 cm. The hole is biconical – a clear indication that it was drilled from both ends. This artefact has a small broken portion that is incompletely ground – perhaps the result of an attempt to repair the damage. I have noticed a similar treatment of broken surfaces among perforated objects from Neolithic sites in the region of Kozani, and interpreted it as a reflection of the importance of these artefacts' visual appearance (Stroulia 2005a). D683 (Figure 10.31) represents roughly half of an artefact that

was much larger than D911P and donut-shaped. This artefact broke before the perforation was completed, but it is clear that the hole was being drilled from both faces. Interestingly, the unfinished hole consists of two opposite roughly circular depressions, an indication that the drill/s was/were solid and had a rounded, not a pointed, end. The fact that the rest of the object is ground suggests that drilling followed grinding/shaping. The unfinished state of this artefact leaves no doubt of its local production. D911P and D683 differ in both size and shape. It is unclear if they had similar functions.

Perforated artefacts are known from other Aegean sites: Knossos (Evans 1964; Warren *et al.* 1968), Sitagroi (Elster 2003b), Makri (Bekiaris 2007, 57), Servia (Mould *et al.* 2000), Dikili Tash (Séfériadès 1992), Zas Cave (Zachos 1999), Sesklo (Tsountas 1908, 322–325), Dimini (Tsountas 1908, 322–325), Makriyalos (Tsoraki 2007), Megalo Nisi Galanis (Stroulia 2005a), Avgi (Tasos Bekiaris, pers. comm.), Koromilia (Tasos Bekiaris, pers. comm.), Franchthi Cave (pers. observ.), Kremasti-Kilada (pers. observ.), and Varemene Goulon (pers. observ.). With the exception of Knossos and Makriyalos, their number per site is small. Their general scarcity perhaps implies that they were valued possessions of a few select members of the Neolithic communities (see also Moundrea-Agrafioti 1996; Perlès 2001, 289; Stroulia 2005).

Perforated artefacts, such as those found in the Neolithic Aegean, have been recovered in other parts of Europe, the Near East, North America, etc. In general, these artefacts are enigmatic. It is unclear if they were hafted or attached to a string. It is equally unclear if they served as weights (including digging stick weights), weapons, gaming pieces, symbols of authority, or something that we have yet to imagine (see Edmonds 1995, 108–111; Elster 2003a; Rosenberg 2010; Runnels *et al.* 2009; Stroulia 2005a; Sutton 2014). The fact, however, that they were often made of visually interesting stones and/or in challenging shapes perhaps indicates non-utilitarian functions.

D745 and 17649P (Figure 10.32) are cobbles with two opposite ovate or elliptical faces. Each face consists of a large flake scar. In both specimens, the smallest face is flattish enough to serve as a base, the other is concave. It is unclear if D745 and 17649P are finished objects. It is also unclear if they represent tools, vessels, or another

Table 10.16. *Non-a posteriori limestone/marble miscellanea*

Name	Prov	Date	Material	Pres	L	W	T
D911P	n/a	n/a	lime/marble	c	6.0	5.9	5.8
B/1/64	B/1/64	FN	lime/marble	c	10.5	5.1	3.0
17671P	n/a	n/a	lime/marble	c	20.1	13.3	10.1
B/1/299[2]	B/1/299	LN	lime/marble	c	2.9	2.3	0.7
D683	1971 back-dirt	n/a	lime/marble	f	10.7	5.0	5.3
17666P	n/a	n/a	lime/marble	f	10.7	9.6	4.2
D745	B/1/52	LN	lime/marble	c	11.1	9.9	5.3
17649P	n/a	n/a	lime/marble	c	11.5	8.0	7.8

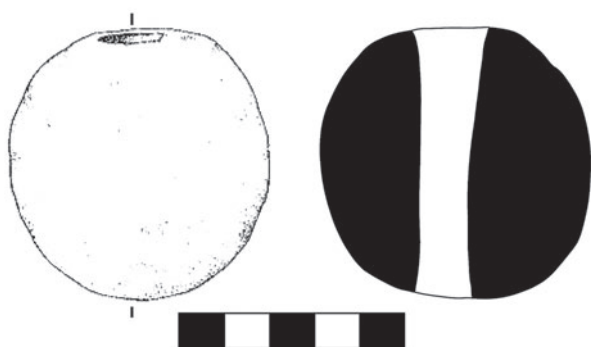


Figure 10.30. Face and section of limestone/marble perforated sphere D911P (drawing by B. Katsipanou-Margeli).



Figure 10.31. Face (top) and section of partially drilled limestone/marble specimen D683 (photos by the author).

type of artefact. I have not been able to locate any parallels in the literature.

D17671P (Figure 10.33) consists of a large water-rolled cobble of a sub-rectangular plan and a roughly trapezoidal section. One of its two opposite faces was ground flat to serve as a base. One of the sides was also flattened. The second (top) face has a concave configuration that dips from one end to the other and is covered with percussion marks. It is unclear if the percussion marks are the result of manufacture or use. I found no parallels in this case either.

Equally uncertain is the function of 17666P. This fragment belongs to an object of a roughly circular plan.



Figure 10.32. Face (top) and profile of 17649P (non-a posteriori limestone/marble miscellanea) (photos by the author).

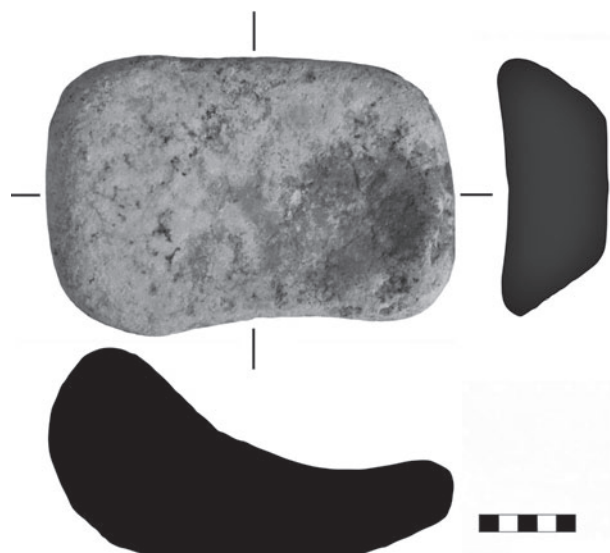


Figure 10.33. Face and sections of D17671P (non-a posteriori limestone/marble miscellanea) (photo by the author, drawings by B. Katsipanou-Margeli).

One of its faces is water-rolled. The other includes a small partly broken depression (4.7×4.3 cm). This depression is pecked to shape and so is the preserved portion of the convex rim that originally surrounded it. This artefact is likely unfinished.

Finally, B/1/64 is a flattish water-rolled cobble with a circular flake scar on one end of one face, whereas B/1/299[2] is a small elliptical flake removed from a water-rolled cobble. I have identified roughly circular/ovate limestone flakes as well as limestone pebbles/cobbles with roughly circular/ovate flake scars in the assemblages of Franchthi Cave (Stroulia 2010, 22–23, 120), Megalo Nisi Galanis (Stroulia 2005a), and Varemni Goulon (pers. observ.).

Hematite

Hematite is a dense material (specific weight of 4.9–5.3) and yields a pigment. The Alepotrypa assemblage includes 17 hematite specimens (6%). They appear in two colours: red/brown and (more rarely) dark grey. Three items – D677a, D17633, and D880-34P – consist of cutting edge tools and have been presented above. The remaining 14 consist of generally globular lumps that are macroscopically similar to those collected on Mina Mountain (c. 10 km south of Diros Bay) by Diros Neolithic Museum guard Antonis Kilakos. I consider this to be a likely source for both these 14 lumps and the aforementioned hematite pieces converted into cutting edge tools. The hematite lumps found at Alepotrypa are presented below.

Used and unused hematite lumps

This group comprises 14 specimens (Table 10.17). More or less specific provenience information is available for 11 of them. Ten come from four chambers: A (n = 1), B (n = 6), D (n = 2), and Z (n = 1). One was recovered in Exterior Excavation Area A (EEAA) immediately outside the cave entrance. Five items (or 45% of those with a known provenience) derive from areas with primary/secondary burials or of non-utilitarian functions: LN/FN female burial of B/1, Ossuary I, Ossuary II, and Z/20. Secure or probable dates are available for nine items. They are distributed as follows: EN:1, LN:1, LN/FN:1, FN:6.

If this distribution is representative, it indicates that these tools were for the most part used in FN.

All but one specimen show evidence of use. The exception is D359 that possibly represents unutilised raw material. Interestingly, it was found in Ossuary II.

All specimens are complete. They range from 3.6 cm to 7.9 cm in maximum dimension. With an average of 4.9 cm, it is clear that most are small, *e.g.*, D1751 (Figure 10.34). There is nothing to indicate that the small size resulted from intense and/or prolonged use. It seems rather that most of the hematite lumps picked as raw material were small to begin with. If so, they must have been suitable for their intended uses.

Hematite lumps were used *a posteriori*. With one exception, they were used actively in an exclusive abrasive mode. The wear in nine cases consists of smoothed flattened faces, smoothed flat or convex facets, or simply smoothed areas. Most of these tools have more than one abrasively used area. Usually one of these areas carries the most intense wear in the form of a face or a facet. I assume that this area was used first. When this area became inconvenient for use, others started being utilised, *e.g.*, D1751 (Figure 10.34) and D375 (illustrated in Papathanassopoulos 2011, 104). The small size of the abrasively used parts and the small size of the tools themselves indicate that the passive surfaces affected by them were limited. The abrasively used areas lack macroscopically visible scratches, an indication that the affected surfaces were not of stone, but rather of a relatively soft material. Wood is a possible candidate. The smoothness of at least some abrasively used areas perhaps supports this hypothesis. The purpose of the abrasion may have been to both burnish a passive surface and create a certain reddish effect.

The surface of three specimens – D411b, D1194, and B/1/227 – is more smoothed than others and indeed both higher and lower spots are smoothed. Such a use wear may be the result of contact with a soft and supple material such as animal skin. The intent may have been

Table 10.17. Used and unused hematite lumps

Name	Prov	Date	Material	Pres	L	W	T
D1194	B/1/180 scarp	n/a	hematite	c	3.6	3.2	2.1
D415	A/4/26	EN?	hematite	c	3.8	3.6	2.4
D698P	n/a	n/a	hematite	c	3.9	3.8	3.1
D191[2]	B/1/35	LN/FN	hematite	c	4.2	4.2	3.9
D252	B/7/136	FN?	hematite	c	4.3	3.9	3.4
D882-40P	n/a	n/a	hematite	c	4.3	4.1	3.8
D1751	EEAA#177	n/a	hematite	c	4.6	4.5	2.6
D411b	B/1/51	LN	hematite	c	4.7	3.6	2.7
D360	D/9/145	FN	hematite	c	5.0	4.4	2.5
D727	Z/20	FN	hematite	c	5.1	4.3	3.1
D359	D/10/146	FN	hematite	c	5.4	5.2	4.8
B/1/227	B/1/227	FN	hematite	c	5.5	4.6	4.3
D375	B/4	FN	hematite	c	6.7	5.2	4.4
D677b	disturbed soil	n/a	hematite	c	7.9	6.7	5.7



Figure 10.34. Face (right) and profile of used hematite lump D1751 (photos by the author).

to smoothen a piece of skin and also give it a certain reddish appearance.

One tool – D677b (Figure 10.35) – was used primarily but not exclusively in an abrasive mode. This is the largest item in this group and can be comfortably held for use. The hematite lump was used intensively in an active abrasive mode resulting in a flattish smoothed face that measures 6.1×5.0 cm. In the centre of this face is a percussively used area, measuring 3.2×2.8 cm. It is the result of a secondary passive or active percussive use. Opposite this face is a smoothed flattened area 4.0×2.9 cm, the result of an active abrasive use. This area is continued by a smooth, narrow, and convex zone used in a similar mode. Finally, a small piece is missing; it was perhaps detached in the context of active percussion. This specimen had a complex biography as it was used in different ways in several contexts. It represents a case of both reuse and recycling.

To the best of my knowledge, the only Aegean Neolithic parallels for the Alepotrypa hematite lumps come from three sites. Kremasti-Kilada yielded a number of utilised and unutilised angular hematite pieces. Those used carry active abrasive wear (Chondrou 2010, 136–138; pers. observ.). The two hematite pieces in the form of cube and pyramid found at Lerna and Franchthi Cave respectively have been interpreted as possible sources of pigment (Banks 2015, 206; Stroulia 2010, 116–117).

The macrolithic assemblage, the cave, and the elephant in the room

The Alepotrypa macrolithic assemblage comprises 289 specimens. Two hundred and two were recovered by archaeologists inside the cave and (in two cases) immediately outside the cave entrance. Thirty-two were collected by the Petrocheilos team. No contextual information whatsoever is available regarding the origin of the remaining 55 items.



Figure 10.35. Face and section of used hematite lump D677b (photo by the author, drawing by B. Katsipanou-Margeli).

In total 193 macrolithics were recovered in specific cave chambers. They are distributed as follows: Chamber A:37 (19%), Chamber B:130 (68%), Chamber D:16 (8%), Chamber Z:6 (3%), Chamber L:4 (2%). The high concentration in Chamber B has to do with Trench B/1, the deep stratigraphical trench dug in the central sector of this chamber; 118 items (61%) come from there.

Secure or probable dates are available for 190 specimens of which 185 are distributed as follows: EN:37 (20%), MN/LN:6 (3%), LN:73 (38%), LN/FN:14 (7%), FN:55 (29%). The remaining five (3%) are generally attributed to EN–FN. There is no reason to consider the larger concentration in LN as an archaeological construct. It appears that more macrolithics were deposited inside the cave during this phase than in EN or FN.

The combined study of the spatial and chronological distribution of the Alepotrypa macrolithics has revealed the following patterns: Chamber A yielded only specimens securely or tentatively dated to EN. Indeed, almost all EN specimens found in the cave come from Chamber A. Chamber B yielded specimens securely or tentatively dated to MN/LN, LN, LN/FN, and FN. Indeed, almost all MN/LN, LN, and LN/FN specimens found in the cave come from Chamber B (namely B/1). Chambers D and L yielded only specimens attributed to FN. Finally, Chamber Z yielded all those generally attributed to EN–FN. It is unclear to what degree these patterns reflect a prehistoric reality and to what extent they have to do with the following two factors: 1) pre-excavation biases – the post-EN deposits of Chamber A were removed before

the archaeological investigations of the cave began; 2) excavation biases – digging in Chamber D and the northern sector of Chamber B never reached the bedrock, whereas Chamber L was investigated only through surface collection.

Four main raw materials are represented among the Alepotrypa macrolithics: limestone/marble ($n = 131$ or 45%), schist ($n = 91$ or 32%), metavolcanic rocks ($n = 49$ or 17%), and hematite ($n = 17$ or 6%). The variety of raw materials used at this site is very small compared to that seen at other sites, such as Franchthi Cave (Stroulia 2010, 126–127), Makriyalos (Tsoraki 2011a), and Avgi (Bekiaris *et al.* 2017). I cannot tell whether this difference is due to prehistoric or modern factors. The difference could be the result of: the sizes of different assemblages; the variety of materials to which different communities had access; these communities' strict or flexible ideas about the suitability of different materials for this or that purpose; or the different classification systems used by the geologists involved in different projects.

None of the raw materials in the Alepotrypa macrolithic industry appears to have been acquired through quarrying or directly from outcrops. All have been collected in the form of water-rolled pebbles, cobbles, and boulders in secondary sources. Some of these materials (*e.g.*, limestone/marble) were available in Diros Bay or not far from it; others (*e.g.*, metavolcanic pebbles/cobbles) were imported from more remote locations in the Mani Peninsula. I assume that procurement of material from close-by sources involved direct expeditions. Material from more remote sources could have been acquired through direct expeditions or exchange with other groups. The logistics of the two strategies are unknown. It is plausible, however, that direct expeditions to the sources were combined with the search for other useful stuff (wild plants and animals, firewood, etc.). On the other hand, exchange of macrolithic raw materials (or even the tools themselves), as well as the exchange of other things, ideas, news, and people, could have been part of inter-communal gatherings, celebrations, feasts, etc., as has been traditionally common in Greece and elsewhere. To state that the Alepotrypa community had an intimate knowledge of the regional landscape and its social universe would be naïve. Nothing less should be expected for people whose very survival depended on a deep familiarity with their physical and social surroundings.

Each raw material was used for more or less specific kinds of tools. It is this clear correspondence between raw material and tool type that compelled me to select raw material as the organising principle of my study.

A few tool types show a chronological concentration (*e.g.*, passive abrasive tools in LN and hematite lumps in FN). The fact, however, that all tool types include specimens from different phases indicates a certain continuity in the procurement of raw materials and the ways these were used in the macrolithic industry.

It further implies that those who procured the raw materials and converted them into tools belonged to the same group that followed similar rules for many generations. This hypothesis is supported by the results of the petrographic analysis of the Alepotrypa pottery (Penteteka, this volume), as well as the biodistance study of the osteological sample (Papathanasiou 2001, 43–44).

Some tool types comprise manufactured implements (*e.g.*, cutting edge tools). Pecking, grinding, flaking, and splitting were the techniques used in macrolithic manufacture. Pecking and flaking were used in the context of curation and redesigning as well. Where macrolithic production took place is not known. With the exception of a certain unfinished artefact and a couple of uncertain cases, no by-products of manufacture have been recovered. For this and other reasons that will become apparent below, I believe that, as a rule, macrolithic tools were made outside the cave.

Regardless of context, macrolithic manufacture was generally simple and did not require specialised skills. The basic competence that any individual acquired growing up in an Aegean Neolithic community must have been sufficient to fashion most or all of the Alepotrypa tools. Yet, I would not rule out a specialisation by gender in the context of manufacture and/or use. In fact, on the basis of ethnographic data, for certain tool types (*e.g.*, food grinding tools) I rather expect it (see Arthur 2014; David 1998; D'Andrea and Mitiku 2002; Hamon and Le Gall 2013; Nixon-Darcus 2014).

Other tool types comprise *a posteriori* implements (*e.g.*, limestone/marble tools with exclusive percussive wear). At least 100 specimens (33%) and possibly as many as 130 (43%) consist of pebbles, cobbles, or boulders put directly to use without prior modification. Their use wear is diverse and ranges from light to heavy. These tools were involved in a large range of activities and were as useful to their users as formal manufactured tools.

Some of the tool types identified at Alepotrypa (*e.g.*, open abrasive tools and cutting edge tools) have parallels in many other Aegean Neolithic assemblages. Others, like the *a posteriori* hematite tools and the metavolcanic tools used percussively with the ends, have but rare parallels. Yet others, like the limestone/marble specimens presented under the name 'non-*a posteriori* specimens produced by splitting', have no parallels. It is uncertain whether the scarcity or absence of comparanda reflects a prehistoric reality or the inadequate publication of many assemblages. Aegean macrolithic industries must be approached in a more systematic manner, if we are to make meaningful comparisons between different assemblages and identify significant patterns across time and space.

None of the Alepotrypa macrolithics has been subjected to microwear or residue analysis. For the most part, nevertheless, these tools appear suitable for a variety of tasks, such as grinding grains and other substances, woodworking, lithic manufacture and maintenance,

shaping bone, shell, and stone artefacts, processing animal skin, and wood/clay burnishing. The Alepotrypa assemblage makes up what could be broadly called a domestic tool kit.

Many of the tools were reused, recycled and/or redesigned. The Alepotrypa people chose specific lithotypes for specific tools, yet their attitudes were flexible enough to allow the use of these tools for other than their original purposes. I noticed a similar pattern at Franchthi Cave (Stroulia 2010). These were rigid materials, but at both sites they became malleable in the hands of their users. I called the Franchthi macrolithics 'flexible stones'. The term can be applied to many specimens from Alepotrypa too.

A substantial number of specimens ($n = 55$ or 28% of those recovered in specific chambers) derive from secure or likely non-utilitarian contexts. Most of these contexts include human remains. Non-utilitarian contexts were found in all five chambers. Indeed, Chambers D, Z, and L yielded only such contexts, whereas the main excavated area in Chamber A had a clear mortuary function. These contexts have been dated to all main phases of the site, a clear indication of its diachronic involvement in special activities.

Almost all non-utilitarian settings included macrolithics. Often multiple specimens were found in each. For example, 22 items were recovered in Ossuary I, nine in the LN/FN female burial of B/1, and six in Ossuary II. All tool types are represented in non-utilitarian settings. Yet, this representation is uneven. Some (*e.g.*, cutting edge tools and limestone/marble *a posteriori* tools with exclusive abrasive wear) are well represented in these contexts. Others (*e.g.*, schist open abrasive tools) are rather rare. It seems that the Alepotrypa people considered certain tool types (and raw materials) more appropriate than others for inclusion in special settings. The factors that determined such appropriateness are elusive. Certainly, the amount of energy invested in the procurement of raw material or manufacture was not one of them: both manufactured tools of imported materials and *a posteriori* tools of local materials were chosen. Completeness was not a determining factor either; both complete and broken tools are represented in these contexts (the complete ones make up the majority, however). Ceramic fragments are a component of these contexts too (Katsarou, this volume). I am not surprised. As I argued elsewhere, the inhabitants of the Neolithic Aegean viewed fragments differently than modern western people: not as dead useless garbage, but as active and lively vehicles of meaning. Moreover, their very definitions of wholes and parts may have been different from ours. We should not assume, for example, that intact cutting edge tools missing their hafts or intact passive grinding tools separated from their active counterparts were defined as complete by people in prehistory as they are by us, macrolithic scholars today (Stroulia and Chondrou 2013; Stroulia 2014; see also

Brittain and Harris 2010; Chapman 2000; Chapman and Gaydarska 2007).

Finally, all macrolithics found in special contexts carry use wear, and often also evidence of curation (*i.e.*, resharpening), reuse, and recycling. Under what circumstances and where use and curation occurred is not known. Nevertheless, I can think of a couple of possibilities. These objects may have been utilised in mundane ways, but ended their lives in non-mundane settings. Some tools, for example, could have been placed with the body of their dead owner or offered to the dead by the living. Alternatively, not only deposition, but also utilisation took place in special settings. Whatever the case, utilisation left no traces that distinguish these specimens from others deposited elsewhere.

Macrolithics have been found in non-utilitarian contexts in a few other Aegean Neolithic sites. Large numbers of complete and fragmentary specimens of various tool types were found in the numerous non-utilitarian pits of Kremasti-Kilada. Some of these pits contained human remains (Hondroyianni-Metoki 2010a; 2010b; Stroulia 2014; Stroulia and Chondrou 2013; Triantaphyllou 2008). Large numbers of macrolithics were also excavated in Pit 212 at Makriyalos, an enormous feature apparently used for feasting events on a massive scale (Pappa *et al.* 2004; Tsoraki 2007). Cutting edge tools were excavated at the 'shrine' of Nea Nikomedeia (Rodden and Rodden 1964), whereas one macrolithic tool derives from a cremation burial at the cemetery of Soufli Magoula (Perlès 2001, 275). Macrolithics have, of course, been recovered in both mortuary and other non-mundane settings in other parts of the world (see Edmonds 1995, 71–72; Barkai 2005, 268–272; Bergsvik and Einar 2011; Farrugia 1992; Graefe *et al.* 2009; Larsson 2004; Lillios 2000; Patton 1991; Skeates 1995, 2002; Wright and Baysal 2012).

What about the much larger number of Alepotrypa macrolithics that were not found in secure or likely non-utilitarian contexts? What do these represent? The convenient response is that they represent material casually discarded after their mundane/domestic use inside the cave. A hypothesis that entails a casual discard of most specimens after a domestic use inside the cave, on one hand, and a deposition of certain specimens in non-utilitarian contexts, on the other, fits well with the proposed scenario of a dual/mixed use of the cave for both domestic/mundane and non-mundane/ceremonial/ritual purposes (*e.g.*, Papathanasiou *et al.* 2013; Katsarou, this volume).

In principle, I do not find a combination of domestic and ritual functions in the same space problematic. Such a combination is well known from Neolithic Greece; for example, mortuary remains have been found again and again in areas interpreted as houses (*e.g.*, Souvatzi 2008, 186–193). It has also been documented in other parts of the Neolithic world (*e.g.*, Bradley 2005). Moreover, I happen to have personal experience of the domestic/

sacred duality. I grew up in the Greek town of Larissa, in a house whose kitchen included a tiny shrine (*εικονοστάσι*): a wooden box containing several religious icons, vials of holy water (*αγίασμα*), and my parents' wedding crowns. In front of this box was an oil candle (*καντηλάκι*). My mother lit it and prayed every evening before we went to bed. There was nothing unusual about this arrangement. It was common in both urban and rural areas.

Yet, at Alepotrypa, I find a combination of domestic and ceremonial uses unlikely and favour instead a single ceremonial function. The reason is no other than the cave environment itself. This environment has three main characteristics: little or no natural light, extremely high levels of humidity, and not a very high temperature. Back Chambers D, Z, and L are completely dark. Front Chambers A and B are relatively dark today, but would have been even darker in the Neolithic, if a hypothesised rock shelter actually existed in front of the cave entrance. The presence of such a rock shelter is supported on geological grounds as well as by the huge mass of fallen rocks found outside the cave. This mass of rocks is not there anymore; it was removed by the Petrocheilos team before the beginning of the archaeological investigations. It was the collapse of this rock shelter c. 3,200 cal BC that, according to this hypothesis, sealed the entrance of the cave and terminated its Neolithic use (Chiotis and Katsipanou 2008).

The cave has 100% humidity throughout the year with constant dripping from the cave ceiling. The high humidity coupled with a (stable) 18°C temperature makes the cave interior feel cold and uncomfortable. That is why individuals who spend substantial periods of time inside the cave (*e.g.*, digging in Trench B/1 or operating the flotation device) wear multiple layers of clothes and a raincoat with the hood on! The final results of the study of the cave's microclimate are still pending; yet, according to preliminary information, the cave environment was not substantially different during the Neolithic (Papathanasiou, pers. comm.). In fact, the speleothem crust covering several macrolithics and other artefacts indicate that the cave was at least as wet in that period as it is today. This kind of environment is suitable for human burials and related or unrelated ceremonies. I find nothing problematic with the 55 macrolithic specimens included among the remains of these non-utilitarian practices.

A dark, wet, and not warm cave is not a suitable place for habitation and work. It is certainly not a hospitable environment for the mundane domestic tasks (grain grinding, woodworking, etc.), in which the remaining macrolithics found inside the cave were probably involved. I find it hard to believe that people used (and casually) discarded a large number of such tools inside such a place, especially given the mild weather outside the cave for most of the year. Likewise, I consider the cave to be an unsuitable environment for

the mundane uses of other artefacts found inside the cave, such as chipped stone tools, bone implements, and spindle whorls. The cave must have been just as unsuitable for the storage purposes supposedly served by the numerous large vessels found in pieces in Chamber B; foodstuffs, like grain, meat, or fish, would not last long in the extreme humid cave conditions. This is especially true for the dehusked cereal grains found inside the cave (Margaritis, this volume).

If macrolithics were not used and casually discarded inside the cave, how can their presence inside the cave be explained? If chipped stone tools, bone implements, spindle whorls, and other artefacts were not utilised and casually abandoned inside the cave, why were they found there? If the large pots of Chamber B served no storage purposes, what was their function? There is no easy answer to these questions (especially without access to detailed excavation data), but I would like to offer an alternative scenario to that of a dual domestic/ceremonial function of the cave.

According to this scenario, after being utilised/worn/broken in the context of all kinds of mundane domestic tasks somewhere outside the cave, macrolithics and other artefacts were brought inside for the purpose of deposition. Likewise, foodstuffs were brought to the cave for deposition, not storage. All these mundane elements of everyday life may have ended their biographies as offerings to some extraordinary entities (the dead buried inside the cave, the god/s of the underworld, the spirits of the cave, etc.). These offerings may not have been much different in their sacrificial treatment than the deliberate breakage of numerous fine decorated pots that took place in Chamber Z (Psimogiannou, this volume) and, like the latter, may have been made in the context of ceremonies. Indeed, the clay floors/platforms found in Chamber B could have been constructed and used in such ceremonial contexts rather than to serve life and work in the cave's unfriendly environment (see also the successive lime plastered floors of Drakaina Cave, which, according to Stratouli (2005), were constructed in a symbolic, not utilitarian, context). The areas with evidence of burning found also in Chamber B may represent not domestic hearths but rather the remains of fires lit in the context of ceremonies (and ceremonial feasts). Likewise, the human bones found scattered throughout the cave may derive from the disarticulation of skeletons that took place during the same ceremonies.

If my hypothesis is correct, a symbolic treatment was reserved for the last stage in the biography not only of macrolithics and other artefacts found in obvious non-utilitarian contexts, but of all macrolithics and other artefacts found inside the cave. If my hypothesis is correct, the cave served as a huge repository of various materials, indeed no different in kind than the repositories represented by the many pits of Kremasti-Kilada and Pit 212 of Makriyalos.

The use of Alepotrypa Cave as a(n exclusively) ritual site would have certainly been a good choice. With its impressive speleothem formations, multi-level ground surface, narrow passage from the front to the back portion, a back chamber with an impressive domed ceiling and a pond, this dark, wet, and uncomfortable cavity would have offered an ideal liminal space whose experience could be manipulated through the effective use of fire, light, smoke, smell (including that of burning dung), sound (utterances, songs, screams, or music), and movement (including dance; see also Bjerck 2012; Mlekuž 2012).

A few years ago, Peter Tomkins (2009) challenged us Aegean prehistorians to revisit our predominantly domestic portrayals of the caves used in the Neolithic period, pay more attention to these caves' physical characteristics and cultural contents, and examine whether (exclusive) ritual functions may have been more likely. Alepotrypa was one of the caves for which he favoured a ritual interpretation. He may have been right.

There is an elephant in the room of my scenario, however. It can be expressed in the two following questions: if the cave was not used for residential purposes, where did the people whose skeletal and cultural remains were found in this space actually live? If the cave did not serve as a settlement, where is the site that served as one? No such site has been identified immediately outside the cave; the finds from the Exterior Excavation Area A were meagre (Papathanassopoulos, pers. comm.). The surface survey of Diros Bay did identify a few concentrations of Neolithic material. None, however, is earlier than the Final Neolithic and thus none corresponds to the earlier phases of the cave's use. Moreover, with one exception, these concentrations are small and unlikely to represent settlements. The exception is the more substantial FN site of Ksagounaki located on a headland adjacent to the cave and the target of on-going excavations. While this site may have served as the associated open-air settlement in the FN, it does not seem to have been occupied before that period (Pullen *et al.*, this volume).

The pre-FN open-air settlement(s) may be submerged in Diros Bay or covered by alluvial deposits. Studies have shown that the sea level of Diros Bay was lower in the Neolithic than it is today. In that period a small coastal plain existed below the cave on what is now the eastern portion of the bay. North of the cave, the coastal plain extended into a valley that is now covered by alluvial deposits (Bassiakos 1993, 331; Dunn 2011; Papathanassopoulos 2011, 40). Both the coastal plain and the valley could have offered room for the settlement of a mixed farming community. The cereals and pulses whose remains were found inside the cave and probably processed with the help of open abrasive tools could have been grown in the surrounding hills. The animals whose bones and dung were also found inside the cave could have grazed on these hills, as well as on higher elevations.

Throughout the Neolithic, the cave could have served as a specialised satellite *locus*, visited periodically and used for mortuary and other ceremonies primarily by members of a community that lived in the area of the bay. These ceremonies could have involved grains and other plant foods, slaughtered animals and their waste, dead human bodies and their skeletal remains, as well as all kinds of artefacts, including macrolithics.

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Notes

- 1 'Linear' and 'diffused' are terms introduced by Leroi-Ghouran (1971, 47–57) to describe two different types of contact between a tool and the worked material. When a tool is used in a linear mode, the contact surface between this and the worked material consists of a line. When a tool is used in a diffused percussive mode, percussion affects a whole area of the worked material.
- 2 A notable exception for northern Greece comes from the Makriyalos assemblage, which comprises over 1800 specimens. The average length of the c. 340 complete specimens is 4.9 cm (Tsoraki 2011a). It would be useful to know, however, how many of the hundreds of fragments derive from larger tools.
- 3 I use here the terms 'ends' and 'sides' for elongated specimens, the term 'periphery' for elliptical specimens.

Bibliography

- Adams, J. (2002) *Ground Stone Analysis: A Technological Approach*. Salt Lake City.
- Adams, J., Delgado, S., Dubreuil, L., Hamon, C., Plisson, H. and Risch, R. (2009) Functional analysis of macro-lithic artefacts. In F. Sternke, L. Costa and L. Eigeland (eds) *Non-Flint Raw Material Use in Prehistory: Old Prejudices and New Directions*, 43–66. (British Archaeological Report S1939). Oxford.

- Alisøy, H. A. (2002) Consumption of ground stone tools at Stavroupoli. In D. Grammenos and S. Kotsos (eds) *Σωστικές Ανασκαφές στο νεολιθικό οικισμό Σταυρούπολης Θεσσαλονίκης*, 561–608. Thessaloniki.
- Arthur, J. W. (2014) Culinary crafts and foods in Southwestern Ethiopia: an ethnoarchaeological study of Gamo groundstones and pottery. *Journal of African Archaeological Review* 31, 131–168.
- Banks, E. C. (2015) *Lerna VII: The Neolithic Settlement*. Princeton.
- Barkai, R. (2005) *Flint and Stone Axes as Cultural Markers: Socio-Economic Changes as Reflected in Holocene Flint Tool Industries of the Southern Levant*. Berlin.
- Bassiakos, Y. (1993) *Χρονολόγηση απολιθωμάτων σπηλαίων και σπηλαιοποθεμάτων με τη μέθοδο του συντονισμού της ηλεκτρονικής στροφορμής και μελέτη μορφολογίας υπόγειου καρστ και των σχετικών ραδιομετρικών και γεωλογικών συνθηκών σε σπηλαιοπεριβάλλοντα της περιοχής Λυρού Μάνης*. Unpublished PhD Dissertation, University of Athens.
- Bekiaris, T. (2007) *Τριπτά εργαλεία από το Νεολιθικό οικισμό της Μάκρης Έβρου*. Unpublished MA Thesis, Aristotle University of Thessaloniki.
- Bekiaris, T. (2012) Ground stone artefacts from the Neolithic settlement of Avgi: A preliminary report. http://www.neolithicavggi.gr/?page_id=494&langswitch_lang=en
- Bekiaris, T. (forthcoming) Ground stone tools from Drakaina Cave: grounds for thought. In G. Stratouli (ed.) *Drakaina Cave on Kefalonia Island: A Place of Social Activity during the Neolithic*.
- Bekiaris, T., Stergiou, C. and Theodoridou, S. (2017) Making choices in a Neolithic landscape: raw materials and ground stone technology in Neolithic Avgi, NW Greece. In A. Sarris, E. Kalogiropoulou, T. Kalayci, and L. Karimali (eds) *Communities, Landscapes, and Interaction in Neolithic Greece*. Proceedings of the International Conference, Rethymno 29–30 May 2015, 415–433. U.S.
- Bergsvik, K. A. and Einar, Ø. (2011) The experienced axe: chronology, condition and context of TRB-axes in western Norway. In V. Davis and M. Edmonds (eds) *Stone Axe Studies III*, 7–20. Oxford.
- Bjerck, H. B. (2012) On the outer fringe of the human world: phenomenological perspectives on anthropomorphic cave paintings in Norway. In K. A. Bergsvik and R. Skeates (eds) *Caves in Context: The Cultural Significance of Caves and Rockshelters in Europe*, 48–64. Oxford.
- Bradley, R. (2005) *Ritual and Domestic Life in Prehistoric Europe*. London and New York.
- Brittain, M. and Harris, O. (2010) Enchaining arguments and fragmenting assumptions: reconsidering the fragmentation debate in archaeology. *World Archaeology* 42, 581–594.
- Chapman, J. (2000) *Fragmentation in Archaeology: People, Places, and Broken Objects in the Prehistory of South-Eastern Europe*. London.
- Chapman, J. and Gaydarska, B. (2007) *Parts and Wholes: Fragmentation in Prehistoric Context*. Oxford.
- Chiotis, E. and Katsipanou, V. (2008) Προβληματισμοί για τον εντοπισμό της αρχικής εισόδου του σπηλαίου Αλεπότρυπα Λιρού Μάνης. *Unpublished paper delivered at the symposium 'Αλεπότρυπα, 50 χρόνια (1958–2008): Η αρχαιολογική αξία και η αναπτυξιακή διάσταση του Νεολιθικού Λιρού'*, Athens, 31 March 2008.
- Chondrou, D. (2010) *Τριπτά εργαλεία από τη νεολιθική θέση της Τούμπας Κρεμαστής Κοιλιάδας*. Unpublished MA Thesis, Aristotle University of Thessaloniki.
- Christopoulou, A. (2000) Τα λειασμένα λίθινα εργαλεία του σπηλαίου Θεόπετρας. In N. Kyprissi-Apostolika (ed.) *Theopetra Cave: Twelve Years of Excavation and Research 1987–1998*, 293–305. Athens.
- Chrysostomou, P., Jagoulis, T. and Maeder, A. (2015) The 'Culture of four lakes': prehistoric lakeside settlements (6th–2nd mill. BC) in the Amindeon Basin, western Macedonia, Greece. *Archäologie Schweiz* 38, 24–32.
- Cristiani, E., Lemorini, C. and Dalmeri, G. (2012) Ground stone tool production and use in the Late Upper Palaeolithic: the evidence from Riparo Dalmeri (Venetian Prealps, Italy). *Journal of Field Archaeology* 37, 34–50.
- D'Andrea, A. K. and Mitiku, H. (2002) Traditional emmer processing in Highland Ethiopia. *Journal of Ethnobiology* 22, 179–217.
- David, N. (1998) The ethnoarchaeology and field archaeology of grinding at Sukur, Adamawa State, Nigeria. *African Archaeological Review* 15, 13–63.
- de Beaune, S. A. (1989a) Essai d'une classification typologique des galets et plaquettes utilisés au Paléolithique. *Gallia Préhistoire* 31, 27–64.
- de Beaune, S. A. (1989b) Exemple ethnographique de l'usage pluri-fonctionnel d'un galet de quartz. *Bulletin de la Société Préhistorique Française* 86, 61–64.
- Delgado Raack, S. and Risch, R. (2009) Towards a systematic analysis of grain processing techniques. In M. Araújo Igreja and I. Clemente Conte (eds) *Proceedings of the Workshop: Recent Functional Studies on Non-Flint Stone Tools: Methodological Improvements and Archaeological Inferences, 23–25 May 2008*, 1–20. Lisbon.
- Dickson, F. P. (1981) *Australian Stone Hatchets: A Study in Design and Dynamics*. Sydney.
- Dunn, K. R. (2011) *Geology and Geomorphology Report, Diros Project, 2011*. Unpublished report, Diros Project archives.
- Edmonds, M. (1993) Towards a context for production and exchange: the polished axe in earlier Neolithic Britain. In C. Scarre and F. Healy (eds) *Trade and Exchange in Prehistoric Europe. Proceedings of a Conference Held at the University of Bristol, April 1992*, 69–86. London.
- Edmonds, M. (1995) *Stone Tools and Society: Working Stone in Neolithic and Bronze Age Britain*. London.
- Efstratiou, N. (1985) *Agios Petros: A Neolithic Site in the Northern Sporades*. (British Archaeological Report S241). Oxford.
- Elster, E. S. (2003a) Grindstones, polished edge-tools, and other stone artefacts. In E. S. Elster and C. Renfrew (eds) *Prehistoric Sitagroi: Excavations in Northeast Greece, 1968–1970*, vol. 2: *The Final Report*, 175–195. (Monumenta Archaeologica 20). Los Angeles.
- Elster, E. S. (2003b) Catalog of grindstones, polished edge-tools, and other stone artefacts. In E. S. Elster and C. Renfrew (eds) *Prehistoric Sitagroi: Excavations in Northeast Greece, 1968–1970*, vol. 2: *The Final Report*, 204–227. (Monumenta Archaeologica 20). Los Angeles.
- Evans, J. D. (1964) Excavations in the Neolithic settlement of Knossos, 1957–60. Part I. *Annual of the British School at Athens* 59, 132–240.
- Evans, J. D. and Renfrew, C. (1968) *Excavations at Saliagos near Antiparos*. (British School at Athens Supplement 5). London.
- Farrugia, J.-P. (1992) *Les outils et les armes en pierre dans le rituel funéraire Néolithique Danubien*. (British Archaeological Report S581). Oxford.

- González, J. E. and Ibáñez, J. J. (2002) The use of pebbles in Eastern Vizcaya between 12000 and 10000 B.P. In H. Procopiou and R. Treuil (eds) *Moudre et broyer: L'interprétation fonctionnelle de l'outillage de moudre et de broyage dans la préhistoire et l'Antiquité*, I: *Méthodes*, 69–80. Paris.
- Graefe, J., Hamon, C., Lidström-Holmberg, C., Tsoraki, C. and Watts, S. (2009) Subsistence, social and ritual practices: quern deposits in the Neolithic societies of Europe. In S. Bonnardin, C. Hamon, M. Lauwers and B. Quilliec (eds) *Du matériel au spirituel: Réalités archéologiques et historiques des "dépôts" de la Préhistoire à nos jours*, 87–96. Antibes.
- Hadou, M. (2011) *Τα λίθινα τριπτά εργαλεία από τον Ηλιόποτο του ανατολικού Λαγκαδά*. Unpublished MA Thesis, Aristotle University of Thessaloniki.
- Hamon, C. (2008) Meules rubanées, meules blicquiennes: Nouvelles réflexions sur les dépôts du Hainaut (Belgique). In L. Burnez-Lanotte, M. Ilett and P. Allard (eds) *Fin des traditions danubiennes dans le Néolithique du Bassin parisien et de la Belgique (5100–4700 av. J.-C.). Autour des recherches de Claude Constantin*, 197–208. (Société Préhistorique Française Mémoire XLIV). Paris.
- Hamon, C. and Le Gall, V. (2013) Millet and sauce: the uses and functions of querns among the Minyanka (Mali). *Journal of Anthropological Archaeology* 32, 109–121.
- Hayden, B. (1987) Past to present uses of stone tools in the Maya Highlands. In B. Hayden (ed.) *Lithic Studies among the Contemporary Highland Maya*, 160–234. Tuscon.
- Hellström, P. (ed.) (1987) *Paradeisos: A Late Neolithic Settlement in Aegean Thrace*. Stockholm.
- Hondroyianni-Metoki, A. (2010a) *Μη οικιστικές χρήσεις χώρου στους νεολιθικούς οικισμούς: Το παράδειγμα της Τούμπας Κρεμαστής Κοιλιάδας*. Unpublished PhD Dissertation, Aristotle University of Thessaloniki.
- Hondroyianni-Metoki, A. (2010b) Η καύση των νεκρών στο νεολιθικό οικισμό της “Τούμπας Κρεμαστής Κοιλιάδας” στην Κίτρην Λίμνη Ν. Κοζάνης. In N. Merousis, E. Stefani and M. Nikolaidou (eds), *ΙΡΙΣ. Μελέτες στη μνήμη της καθηγήτριας Αγγελικής Πιλάλη-Παπαστερίου*, 213–234. Thessaloniki.
- Julien, M. (1985) L'outillage lithique non façonné. In D. Lavallée, M. Julien, J. Wheeler, and C. Karlin (eds) *Telarmachay: Chasseurs et pasteurs préhistoriques des Andes I*, 207–213. Paris.
- Larsson, L. (2004) *Of maces and men: symbols in a landscape of cultural diversity*. *Journal of Nordic Archaeological Science* 14, 71–78.
- Larsson, L. (2011) The ritual use of axes. In V. Davis and M. Edmonds (eds) *Stone Axe Studies III*, 203–214. Oxford.
- Leroi-Gourhan, A. (1971) *Évolution et techniques: L'homme et la matière*. Paris.
- Lidström Holmberg, C. (2004) Saddle querns and gendered dynamics of the Early Neolithic in Mid Central Sweden. In H. Knutson (ed.) *Arrival: Coast to Coast 10*, 199–231. (Coast to Coast 10). Uppsala.
- Liebowitz, H. A. (2008) Wear patterns on ground stone implements from Tel Yin'am. In Y. Rowan and J. Ebeling (eds) *New Approaches to Old Stones: Recent Studies of Ground Stone Artefacts*, 182–195. London.
- Lillios, K. T. (2000) A biographical approach to the ethnogeology of Late Prehistoric Portugal. *Trabajos de Prehistoria* 57, 19–28.
- Menasanch, M., Risch, R. and Soldevilla, J. A. (2002) Las tecnologías del procesado de cereal en el sudeste de la península ibérica durante el III y el II milenio A.N.E. In H. Procopiou and R. Treuil (eds) *Moudre et broyer: L'interprétation fonctionnelle de l'outillage de moudre et de broyage dans la préhistoire et l'Antiquité*, I: *Méthodes*, 81–110. Paris.
- Mlekuž, D. (2012) Notes from the underground: caves and people in the Mesolithic and Neolithic Karst. In K. A. Bergsvik and R. Skeates (eds) *Caves in Context: The Cultural Significance of Caves and Rockshelters in Europe*, 199–211. Oxford.
- Mould, C. A., Ridley, C. and Wardle, K. A. (2000) The stone small finds. In C. Ridley, K. A. Wardle, and C. A. Mould (eds) *Servia I: Anglo-Hellenic Rescue Excavations*, 112–161. (British School at Athens Supplement 32). London.
- Moundrea-Agrafioti, A. (1981) *La Thessalie du Sud-Est au Néolithique: Outillage lithique et osseux*. Unpublished PhD Dissertation, University of Paris X.
- Moundrea-Agrafioti, A. (1996) Tools. In G. Papathanassopoulos (ed.) *Neolithic Culture in Greece*, 103–106. Athens.
- Mylonas, G. E. (1929) *Excavations at Olynthus I: The Neolithic Settlement*. Baltimore.
- Ninou, I. (2006) *Analysis of Grinding Stones from Neolithic Sites of Northern Greece: Dispilio and Apsalos*. Unpublished MA Thesis, University of Southampton.
- Nixon-Darcus, L. A. (2014) *The Cultural Context of Food Grinding Equipment in Northern Ethiopia: An Ethnoarchaeological Approach*. Unpublished MA Thesis, Simon Fraser University.
- Papathanasiou, A. (2001) *A Bioarchaeological Analysis of Neolithic Alepotrypa Cave, Greece*. (British Archaeological Report S961). Oxford.
- Papathanasiou, A. (2009) Mortuary behaviour in the Alepotrypa Cave: assessments from the study of the human osteological material. In W. G. Cavanagh, C. Gallou, and M. Georgiadis (eds) *Sparta and Laconia: From Prehistory to Pre-Modern. Proceedings of the Conference Held in Sparta, Organised by the British School at Athens, the University of Nottingham, the 5th Ephoreia of Prehistoric and Classical Antiquities and the 5th Ephoreia of Byzantine Antiquities, 17–20 March 2005*, 21–28. (British School at Athens Studies 16). London.
- Papathanasiou, A., Karkanis, P., Papathanassopoulos, G., Katsarou, S., Valvis, G. and Psimogiannou, K. (2013) Alepotrypa Cave, Diros, 6000–3500 BC: New evidence sheds new light on the excavated material. *Unpublished paper delivered at the international conference 'Communities in Transition: The Circum-Aegean Later Neolithic Stages (ca. 5000/4800–3200/3000 BC)'*, Athens.
- Papathanassopoulos, G. (2011) *Το Νεολιθικό Διρό: Σπήλαιο Αλεπότρυπα*. Athens.
- Pappa, M., Halstead, P., Kotsakis, K. and Urem-Kotsou, D. (2004) Evidence for large-scale feasting at Late Neolithic Makriyalos, N. Greece. In P. Halstead and J. C. Barrett (eds) *Food, Cuisine, and Society in Prehistoric Greece*, 16–44. (Sheffield Studies in Aegean Archaeology 5). Oxford.
- Patton, M. A. (1991) Axes, men, and women: Symbolic dimensions of Neolithic exchange in Armorica (North-West France). In P. Garwood, D. Jennings, R. Skeates,

- and J. Toms (eds) *Sacred and Profane: Proceedings of a Conference on Archaeology, Ritual and Religion*, Oxford, 1989, 65–79. (Oxford University Committee for Archaeology Monograph 32). Oxford.
- Perlès, C. (1981) Industries lithiques. In N. Lambert (ed.) *La grotte préhistorique de Kitsos (Attique). Missions 1968–1978*, 123–222. Athens.
- Perlès, C. (2001) *The Early Neolithic in Greece*. Cambridge.
- Pétrequin P., Cassen, S., Croutsch, C. and Errera, M. (2002) La valorisation sociale des longues haches dans l'Europe néolithique. In J. Guilaine (ed.) *Matériaux, productions, circulations du Néolithique à l'Âge du Bronze*, 67–98. Paris.
- Petrocheilos, J., and Petrocheilos, A. (1961) Ανακάλυψις λειψάνων προϊστορικών ανθρώπων εις την περιοχὴν Δυρὸύ Λακωνίας. *Δελτίο Ἑλληνικῆς Σπηλαιολογικῆς Εταιρείας* 6, 3–9.
- Phillipson, L. (2001) Grindstones and related artefacts from Aksum, Ethiopia. *Lithics* 22, 13–21.
- Pullen, D. J., Papathanasiou, A., Parkinson, W. A., Karkanas, P. and Galaty, M. L. (2014) Alepotrypa Cave and its regional context in the Late and Final Neolithic Aegean. *Unpublished paper delivered at the 79th Annual Meeting of the Society for American Archaeology*, Austin.
- Renard, J. (1989) *Le site néolithique et helladique ancien de Kouphovouno (Laconie). Fouilles de O.-W. von Vacano (1941)*. Paris.
- Risch, R. (2008) Grain processing technologies and economic organisation: a case study from the south-east of the Iberian Peninsula during the Copper Age. *Arkeotek Journal* 2, 1–47.
- Robitaille, J. (2015) *Analyse fonctionnelle de l'outillage de broyage de Tell el-Iswid: Approche expérimentale et ethnographique*. (Mémoire de Master 2). Saarbrücken.
- Rodden, R. J. (1962) Excavations at the Early Neolithic site at Nea Nikomedeia, Greek Macedonia (1961 Season). *Proceedings of the Prehistoric Society* 28, 267–288.
- Rodden, R. J. and Rodden, J. M. (1964) A European link with Chatal Huyuk: the 7th millennium settlement of Nea Nikomedeia in Macedonia. Part II: Burials and the shrine. *Illustrated London News* (April), 604–607.
- Rosenberg, D. (2010) Early maceheads in the Southern Levant: a “Chalcolithic” hallmark in Neolithic context. *Journal of Field Archaeology* 35, 204–216.
- Runnels, C. N. (1981) *A Diachronic Study and Economic Analysis of Millstones from the Argolid, Greece*. Unpublished PhD Dissertation, Indiana University.
- Runnels, C. N. (1985) Trade and the demand for millstones in Southern Greece in the Neolithic and the Early Bronze Age. In B.A. Knapp and T. Stech (eds) *Prehistoric Production and Exchange: The Aegean and Eastern Mediterranean*, 30–43. Los Angeles.
- Runnels, C., Payne, C., Rifkind, N., White, C., Wolff, N. and LeBlanc, S. (2009) Warfare in Neolithic Thessaly: a case study. *Hesperia* 78, 165–194.
- Samuel, D. (2010) Experimental grinding and ancient Egyptian flour production. In S. Ikram and A. Dodson (eds) *Beyond the Horizon: Studies in Egyptian Art, Archaeology and History in Honour of Barry J. Kemp*, 456–477. Cairo.
- Schelberg, J. D. (1997) The metates of Chaco Canyon, New Mexico. In F. J. Mathien (ed.) *Ceramics, Lithics and Ornaments of Chaco Canyon: Analyses of Artifacts from the Chaco Project 1971–1978*, 3, 1013–1117. Santa Fe.
- Schroth, A. B. (1996) An ethnographic review of grinding, pounding, pulverizing, and smoothing with stones. *Pacific Coast Archaeological Society Quarterly* 32, 55–75.
- Séfériadès, M. (1992) La pierre polie. In R. Treuil (ed.) *Dikili Tash: Village préhistorique de Macédoine orientale, fouilles de Jean Deshayes (1961–1975)*, I, 84–99. Athens.
- Skeates, R. (1995) Animate objects: a biography of prehistoric ‘axe-amulets’ in the central Mediterranean region. *Proceedings of the Prehistoric Society* 61, 279–301.
- Skeates, R. (2002) Axe aesthetics: stone axes and visual culture in prehistoric Malta. *Oxford Journal of Archaeology* 21, 13–22.
- Souvatzis, S. G. (2008) *A Social Archaeology of Households in Neolithic Greece: An Anthropological Approach*. Cambridge.
- Starnini, E. and Voytek, B. (1997) New lights on old stones: the ground stone assemblage from the Bernabò Brea excavation at Arene Candide. *Memorie dell'Istituto Italiano di Paleontologia Umana* 5, 427–511.
- Stratouli, G. (2002) Τα εργαλεία από λειασμένο λίθο, οστό και κέρατο. In G. Hourmouziadis (ed.) *Δισπηλιό 7500 χρόνια μετά*, 155–174. Thessaloniki.
- Stratouli, G. (2005) Symbolic behavior at places of social activity beyond the domestic area in the Ionian Neolithic. *Documenta Praehistorica* 32, 123–132.
- Stroulia, A. (2003) Ground stone celts from Franchthi Cave: a close look. *Hesperia* 72, 1–30.
- Stroulia, A. (2005a) Λίθινα τριπτά απο την Κίτρινη Λίμνη Κοζάνης: Πρώτη προσέγγιση, πρώτα ερωτήματα. *Αρχαιολογικό Έργο στη Μακεδονία και Θράκη* 17 (2003), 571–580.
- Stroulia, A. (2005b) Making celts, un-making celt workshops at Neolithic Makri, Greece. *Unpublished paper delivered at the 70th Annual Meeting of the Society for American Archaeology, Salt Lake City*.
- Stroulia, A. (2010) *Flexible Stones: Ground Stone Tools from Franchthi Cave*. Bloomington and Indianapolis.
- Stroulia, A. (2014) Εργαλεία με κόψη από την Κρεμαστή Κοιλιάδα, νομού Κοζάνης: Βιογραφικές παρατηρήσεις. *Το Αρχαιολογικό Έργο στη Μακεδονία και στη Θράκη* 24, 63–71.
- Stroulia, A. and Chondrou, D. (2013) Destroying the means of production: the case of ground stone tools from Kremasti-Kilada, Greece. In J. Driessen (ed.) *Destruction: Archaeological, Philological and Historical Perspectives*, 109–131. Louvain.
- Stroulia, A., Dubreuil, L., Robitaille, J. and Nelson, K. (2017) Salt, sand, and saddles: exploring an intriguing work face configuration among grinding tools. *Ethnoarchaeology* 9, 1–27.
- Sugaya, C. (1993) The stone axes of Tharrounia. In A. Sampson (ed.) *Σκοτεινή Θαρρουνίων. Το σπήλαιο, ο οικισμός και το νεκροταφείο*, 442–447. Athens.
- Sutton, E. (2014) Digging stick weights and doughnut stones: an analysis of perforated stones from the Santa Barbara Channel region. *Journal of California and Great Basin Anthropology* 34, 17–42.
- Tomkins, P. (2009) Domesticity by default: ritual, ritualization and cave-use in the Neolithic Aegean. *Oxford Journal of Archaeology* 28, 125–153.
- Toth, N. and Schick, K. (2009) The importance of actualistic studies in Early Stone Age research. In K. Schick and N. Toth

- (eds) *The Cutting Edge: New Approaches to the Archaeology of Human Origins*, 267–344. Gosport, Indiana.
- Touloumis, K. (2002) Η οικονομία ενός Νεολιθικού λιμναίου οικισμού. In G. Hourmouziadis (ed.) *Δισπηλιό 7500 χρόνια μετά*, 89–113. Thessaloniki.
- Triantaphyllou, S. (2008) Living with the dead: a re-consideration of mortuary practices in the Greek Neolithic. In V. Isaakidou and P. Tomkins (eds), *Escaping the Labyrinth: The Cretan Neolithic in Context*, 139–157. (Sheffield Studies in Aegean Archaeology 8). Oxford.
- Tsiolaki, E. (2009) *Τριπτά λίθινα εργαλεία της Μέσης και Υστερης Εποχής του Χαλκού από την Τούμπα Θεσσαλονίκης*. Unpublished MA Thesis, Aristotle University of Thessaloniki.
- Tsoraki, C. (2007) Unravelling ground stone life histories: the spatial organization of stone tools and human activities at LN Makriyalos, Greece. *Documenta Praehistorica* 34, 289–297.
- Tsoraki, C. (2011a) Stone-working traditions in the Prehistoric Aegean. In V. Davis and M. Edmonds (eds) *Stone Axe Studies III*, 231–244. Oxford.
- Tsoraki, C. (2011b) Disentangling Neolithic networks: ground stone technology, material engagements and networks of action. In A. Brysbaert (ed.) *Tracing Prehistoric Social Networks through Technology: A Diachronic Perspective on the Aegean*. 12–29. New York.
- Tsountas, C. (1908). *Αι προϊστορικοί Ακροπόλεις Σέσκλου και Διμηλίου*. Athens.
- Valamoti, S. M., Chondrou, D. and Papadopoulou, L. (2013) Plant food processing and ground stone equipment in prehistoric Greece. In P. C. Anderson, C. Cheval and A. Durand (eds) *Regards croisés sur les outils liés au travail des végétaux: An Interdisciplinary Focus on Plant-Working Tools*, 169–187. Antibes.
- Voytek, B. (1990) The use of stone resources. In R. Tringham and D. Krstić (eds) *Selevac: A Neolithic Village in Yugoslavia*, 437–484. Los Angeles.
- Warren, P. M., Jarman, H. N., Jarman, M. R., Schackleton, N. J. and Evans, J. D. (1968) Knossos Neolithic, Part II. *The Annual of the British School at Athens* 63, 239–276.
- Wijnen, M.-H. (1982) *The Early Neolithic I at Sesklo: An Early Farming Community in Thessaly, Greece*. Leiden.
- Winn, S. and Shimabuku, D. (1989) Bone and ground stone tools. In M. Gimbutas, S. Winn and D. Shimabuku (eds) *Achilleion: A Neolithic Settlement in Thessaly, Greece, 6400–5600 BC*, 259–272. Los Angeles.
- Wright, K. I. (1991) The origins and development of ground stone assemblages in Late Pleistocene Southwest Asia. *Paléorient* 17, 19–45.
- Wright, K. I. (1992) A classification system for ground stone tools from the Prehistoric Levant. *Paléorient* 18, 53–81.
- Wright, K. I. (2013) The ground stone technologies of Çatalhöyük. In I. Hodder (ed.) *Substantive Technologies from Çatalhöyük: Reports from the 2000–2008 seasons*, 365–416. (Çatalhöyük Research Project Series 9). Los Angeles.
- Wright, K. and Baysal, A. (2012) Ground stone tools and technologies associated with buildings in the BACH Area at Çatalhöyük. In R. Tringham and M. Stevanović (eds) *Last House on the Hill: BACH Area Reports from Çatalhöyük, Turkey*, 415–422. Los Angeles.
- Yeroussi, S. (1999) *Τριπτά και λειασμένα εργαλεία από το Μακρύγαλο Πιερίας*. Unpublished MA Thesis, Aristotle University of Thessaloniki.
- Zachos, K. L. (1999) Zas Cave on Naxos and the role of caves in the Aegean Late Neolithic. In P. Halstead (ed.) *Neolithic Society in Greece*, 153–163. (Sheffield Studies in Aegean Archaeology 2). Sheffield.

Patterns of exploitation and exchange: preliminary compositional results of the obsidian assemblage from Alepotrypa Cave

Danielle J. Riebe

Introduction

Obsidian exchange was studied extensively in the 20th century (Cherry and Torrence 1984; Perlès 1989, 1992; Runnels 1982, 1985), and over the last 50 years research also has included compositional analysis of the material (Cann and Renfrew 1964; De Francisco *et al.* 2008; Perlès *et al.* 2011; Renfrew 1969; Renfrew *et al.* 1965; Tykot 1997; 2002; and 2011). In the Mediterranean, numerous obsidian sources exist that could have been exploited in the past, including Anatolian, Italian and Greek ones. While most of these sources were accessible and utilised in prehistory, at a majority of sites in Greece where compositional studies have been conducted on obsidian, the materials primarily have originated from the island of Melos (Shelford *et al.* 1982, 191). Two obsidian quarries have been identified and extensively surveyed on Melos, Sta Nychia and Demenegaki (see Torrence 1982, 1986; Figure 11.1). Although the two quarries bear similar macroscopic characteristics, research has revealed that the compositional differences are distinct for each location (Arias *et al.* 2006; Aspinall *et al.* 1972; Aspinall and Feather 1978; Bigazzi *et al.* 1986; Cann and Renfrew 1964; Perlès *et al.* 2011; Renfrew *et al.* 1965; Shelford *et al.* 1982; Thorpe 1978; Williams-Thorpe 1995). While this is well known, archaeologists continue to rely heavily on macroscopic analysis in order to determine obsidian provenience. This limits their ability to understand obsidian exploitation in the past and the significance in quarry preference over time. This chapter attempts to partly rectify this oversight by presenting the compositional results, analysed over the past four years, of the obsidian assemblage from the site of Alepotrypa Cave on the Mani Peninsula in the southern Peloponnese.

Case study

As described in previous chapters, work at the site of Alepotrypa has been on going since the 1970s. Much research has been carried out on the cave and the materials recovered during the multiple seasons of excavations. Dr Georgia Kourtessi-Philippakis has focused on the technological analysis of the lithics from Alepotrypa (Chapter 9): a total of 863 pieces have been excavated from throughout the cave and examined. 91.5% of the assemblage is classified as obsidian, with the remaining 8.5% representing various other siliceous materials, typically flint or chert (Kourtessi-Philippakis 2008, 2009, this volume). While it was assumed that the obsidian originated from the island of Melos, this hypothesis was never tested nor was it clear from which quarry the material derived. In this chapter, I report the compositional results of the obsidian artefacts from Trench B1 and then compare the data to previously published Melian compositional results. In sourcing the obsidian to the quarries exploited, I also will assess depositional patterns to note changes in quarry usage over time.

The material

As discussed by Papathanasiou (Chapter 2), the earliest levels of the cave date to the Early Neolithic (c. 6,000 cal BC) and the latest levels date to the Final Neolithic (c. 4,500–3,200 cal BC). A tentative cultural sequence has been provided by Papathanasiou (Chapter 2) and this will be used to assess changes in obsidian exploitation over time (see Table 2.2). Several periods of disturbed or unsecured contexts have been noted in the tentative sequence and these will be taken into account during the

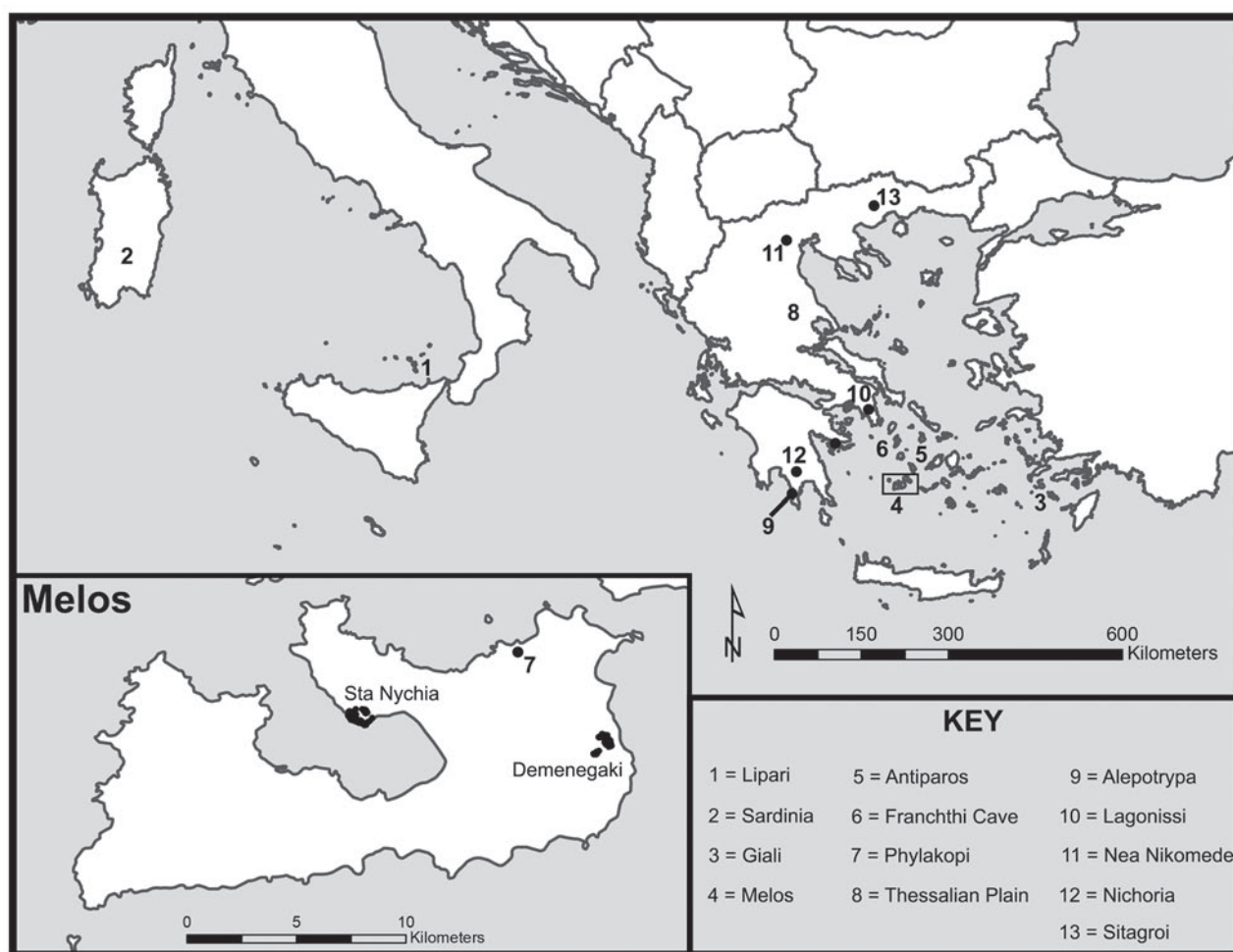


Figure 11.1. Map of sites mentioned in the text; inset map of the two Melian quarries of Sta Nychia and Demenegaki.

interpretation. While attempts have been made to link the radiocarbon data of Trench B1 to other parts of the cave, the lack of uniformity in cave deposition has made this a difficult task. Therefore, in my current study, I have focused exclusively on the obsidian assemblage from Trench B1. Of the total 791 obsidian pieces analysed thus far, 238 obsidian artefacts were recovered from Trench B1 in Alepotrypa, and they primarily are associated with the Late and Final Neolithic cultural levels (see Kourtesi-Philippakis, this volume).

Methods

From 2012–2014, 791 obsidian artefacts from Alepotrypa Cave and the contemporaneous open-air site of Ksagounaki were assessed compositionally using a Bruker portable X-ray fluorescence device (p-XRF) on loan from the Field Museum of Natural History in Chicago, Illinois, USA. The Bruker TRAcER III-SD is equipped with an Rh anode in the X-ray tube. The instrument was set to analyse each sample for 300 seconds at 40 kv and 10 μ A. Each sample was calibrated based on 40 reference standards that were developed by

Bruker and MURR. The calibrated data was processed in GAUSS and then compared to the compositional signatures of Melian geological materials previously published by Perlès *et al.* (2011).

Results

As noted above, 238 obsidian samples were recovered from Trench B1, from between 0.42–3.93 m. in depth. All of the materials were analysed using the p-XRF (Appendix 11.1); principal components analysis was carried out on the results. A bivariate plot with principal components 1 (PC1) and principal components 2 (PC2) reveals a distinct difference in the composition of the lithic materials (Figure 11.2). By comparing the Alepotrypa results to the Melian geological results generated by Perlès *et al.* (2011), 62 samples (26.05%) likely originated from Demenegaki and the remaining 176 samples (73.95%) seem to have originated from Sta Nychia (see Appendix 1 for complete compositional results for each sample). Based on stratigraphical observations and C14 data, the obsidian lithics from Trench B1 were correlated with the main cultural phases represented in the sequence

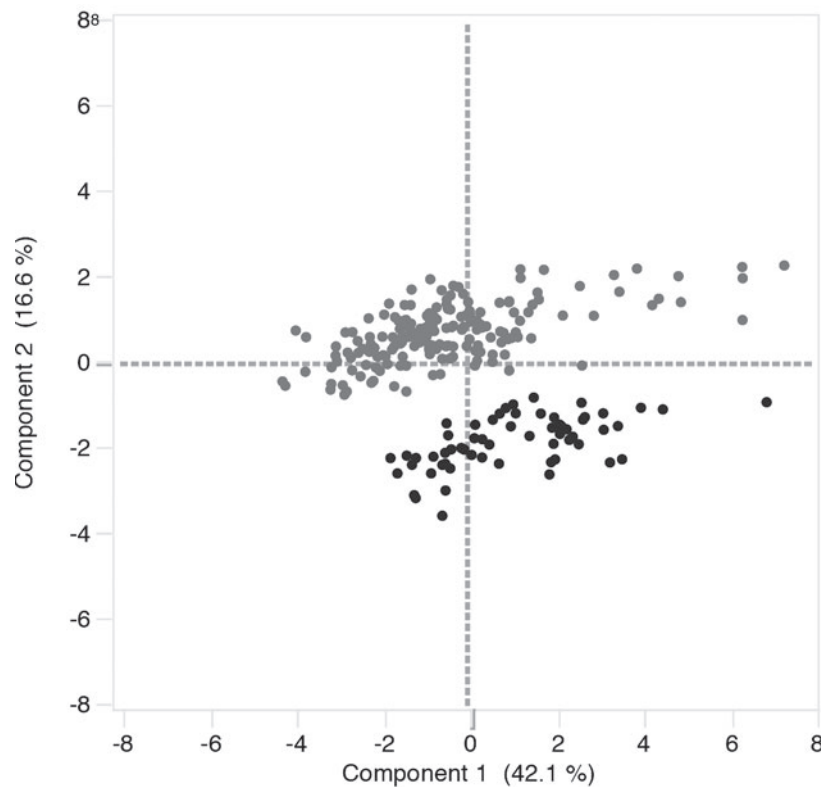


Figure 11.2. Bivariate plot of log base-10 concentrations of principal component 1 (42.1% of the variance) and principal component 2 (16.6% of the variance) illustrating the compositional difference in the obsidian assemblage. Grey dots are materials from Sta Nychia and black dots are materials from Demenegaki.

and assessed further in order to tease out any patterns in quarry exploitation (Tables 11.1 and 2; Table 11.3 in more detail).

The oldest cultural habitation layers dating to the Early Neolithic, located around 4.80 metres in depth, yielded no obsidian finds. The earliest obsidian artifacts come from non-radiocarbon dated Late Neolithic layers, approximately 2.80–4.00 m below the current surface in the cave. Within those cultural layers, 15 pieces (42.86%) are sourced to Demenegaki and 20 artefacts (57.14%) originated from Sta Nychia. In the secure Late Neolithic layers, roughly 1.80–2.80 m below the surface and dating to c. 5,500–4,500 cal BC, a total of 78 obsidian pieces were recovered. Of those, 13 samples (16.67%) are sourced to Demenegaki and 65 samples (83.33%) to Sta Nychia. The next layers, measuring 1.20–1.80 m in depth from the surface, contain mixed Final and Late Neolithic contexts. Within these cultural layers a total of 86 obsidian items were recovered and 26 (30.23%) were sourced to Sta Nychia, and 60 (69.77%) to Demenegaki. The last phase of occupation dates to the Final Neolithic and is from the current surface of the cave to 1.2 metres in depth. Twenty obsidian lithics represent these cultural layers and of those four (20%) are from Demenegaki and 16 (80%) are from Sta Nychia. Additionally, another 19 items were recorded as being excavated from Trench B1, but contained no depth information. Four (21.05%)

Table 11.1. Obsidian from Trench B1, correlated with main cultural phases

Period	C^{14} Date range cal BC	Depth (m)
Final Neolithic	4,500–3,200	0–1.20
Final Neolithic/Late Neolithic (disturbed)		1.20–1.80
Late Neolithic	5,500–4,500	1.80–2.80
Late Neolithic (not secure)		2.80–4.00
Late Neolithic/Middle Neolithic	c. 5,500	4.00–4.30/4.60
Late Early Neolithic	c. 6,000	4.60–4.80

were sourced to Demenegaki, while 15 (78.94%) were from Sta Nychia.

Discussion

Obsidian was commonly used in the Neolithic. Other sites from this period throughout Greece have yielded a similar frequency to that at Alepotrypa Cave. For example, excavators at the 5th millennium BC cave site of Zas on the island of Naxos have determined that 98% of all lithic materials were obsidian (likely from Melos), while flint constituted only 2% of the assemblage (Zachos 1999). Another contemporaneous Final Neolithic site, Ayios Dhimitrios, is located in the south-west Peloponnese. One

Table 11.2. The total number of obsidian samples analyzed with a p-XRF, with the associated depth and potential quarry information

Period	C^{14} date range cal BC	Depth (m)	Demenegaki	Sta Nychia	Total obsidian samples
Final Neolithic	3,200–4,500	0–1.20	4	16	20
Final Neolithic/Late Neolithic (disturbed)	–	1.20–1.80	26	60	86
Late Neolithic	4,500–5,500	1.80–2.80	13	65	78
Late Neolithic (not secure)	–	2.80–4.00	15	20	35
Unknown depth	–	–	4	15	19
Total			62	176	238

of the few excavated open-air settlements dating to this period, it is situated some distance from the sea. While the settlement location differs, it is interesting to note that the lithic assemblage appears strikingly comparable to that of Alepotrypa. Of the 319 lithics recovered from secure Final Neolithic contexts, 89.70% of the material is obsidian (Zachos 2008, 232). Although the lithic assemblages from these contemporary sites appear similar, nothing is yet known about the sources of the Zas and Ayios Dhimitrios obsidian assemblages.

All of the obsidian analysed from Trench B1 in Alepotrypa likely originated from Melos. Most of the artefacts seem to have come from the Sta Nychia quarry (73.95%), while Demenegaki obsidian represents 26.05% of the entire obsidian assemblage. The reliance on Sta Nychia obsidian is not exclusive to Alepotrypa, and the same pattern is repeated at many other sites in Greece where compositional analysis has been conducted, including Franchthi, Lagonissi, Nea Nikomedeia, Nichoria, and Sitagroi (Shelford *et al.* 1982, 191). As previously mentioned, while it is recognised that both Sta Nychia and Demenegaki have unique compositional signatures, these aforementioned studies tended to treat the quarries as one source and did not focus on patterns in quarry preference within Melos.

By more closely examining the material from Trench B1 in Alepotrypa, patterns of exploitation and change related to Melian obsidian can be discerned. When organised chronologically, the obsidian assemblage indicates a potential shift in exploitation over time. The finds from the lowest layers (likely Late Neolithic, 2.80–4.00 m), though lacking secure C14 dates, exhibit relatively equal proportions from Demenegaki (42.86%) and Sta Nychia (57.14%). Since these layers are located below the secure Late Neolithic contexts, they presumably are earlier. In the firmly dated Late Neolithic cultural layers (1.80–2.80 m), the exploitation pattern shifted and there was an abundance of obsidian from the Sta Nychia quarry. As indicated by the compositional results, this reliance on the Sta Nychia quarry continues through the uppermost cultural layers of the Final Neolithic (c. 4,500–3,200 cal BC). What would account for such a change in the quarry preference on Melos?

Perlès has made a strong argument for the presence of specialised trade in the Late Neolithic when investigating

obsidian technology at various sites throughout the Aegean. She noted that while it is unlikely that full-time specialisation was practised in the Early and Middle Neolithic periods, village-craft specialisation likely occurred as an important form of cooperation within and between communities, in order to secure utilitarian goods that would otherwise be unattainable (Perlès 1989, 1992).

Perlès argued that from the Late Neolithic and into the Final Neolithic there was a technological shift suggesting a change in obsidian procurement. In the lithic assemblage from earlier levels at the Franchthi cave, she identified a certain amount of uniformity in obsidian technology, including the presence of preformed cores and pressure-flaked blades. However, the Late Neolithic material exhibited more varied stages of processing (Perlès 1989, 1992). There also was an increase in percussion flaking, a less skilled processing technique. Perlès surmised that changes in procurement were directly related to the occupation of the Cycladic islands, which were largely uninhabited until the Late Neolithic (Cherry 1981). The more intensive settlement of the islands allowed for the establishment of a direct supply zone and thus more direct access to Melian obsidian, eschewing a dependency on access through specialists. When contextualised within this broader, regional framework, the shift in obsidian-source proportions at Alepotrypa during the later Neolithic may reinforce this idea of reorganisation of obsidian procurement, and indicate more direct access by non-specialists.

Conclusion

The results generated from this project compliment the work previously carried out on obsidian in the Aegean. While many compositional studies have sourced raw materials, research has not focused on how lithic composition and depositional context can be used to infer changes in procurement and potentially trade over time. Focusing on the diachronic variation in obsidian from Trench B1, the analysis completed thus far on the obsidian from Alepotrypa Cave constitutes a tempting argument for a potential shift in procurement strategies during the later Neolithic. Future work will include more data from other sections of Alepotrypa, as well as the contemporaneous open-air settlement in Diros Bay, Ksagounaki (see Pullen

Table 11.3. Inventory of each sample analyzed with the p-XRF, including the samples' unique identifier, depth, period, and potential quarry information

Sample	Inventory no.	Depth (m)	Source	Sample	Inventory no.	Depth (m)	Source
<i>Final Neolithic (3,200–4,500 BC)</i>				261	90 a	1.45–1.55	S
362	74 a	0.42–0.50	D	285	90 g	1.45–1.55	D
52	74 d?	0.42–0.50	D	292	91 E	1.45–1.55	S
567	74 d	0.42–0.50	S	297	90 b	1.45–1.55	S
268	176	0.72–0.82	S	299	60 a	1.45–1.55	S
535	154	0.72–0.82	D	301	90 k	1.45–1.55	D
283	83	0.94–1.02	D	302	166 g	1.45–1.55	D
225	180 E	1.02–1.14	S	331	90 n	1.45–1.55	D
41	180 a	1.02–1.14	S	376	90 sT	1.45–1.55	S
247	180 g (?)	1.02–1.14	S	457	166 z	1.45–1.55	D
473	180 sT	1.02–1.14	S	497	60 b	1.45–1.55	D
511	180	1.02–1.14	S	518	3551	1.45–1.55	S
546	180 g	1.02–1.14	S	519	166 E	1.45–1.55	S
551	180 d	1.02–1.14	S	524	166 d	1.45–1.55	D
451	97 sT	1.03–1.13	S	541	166 sT	1.45–1.55	S
23	75 sT	1.14–1.20	S	548	90 l	1.45–1.55	D
47	75 g	1.14–1.20	S	556	166 w	1.45–1.55	D
264	75 b	1.14–1.20	S	557	166 b	1.45–1.55	S
404	75 a	1.14–1.20	S	561	90 Ø	1.45–1.55	S
536	146 E	1.14–1.20	S	598	90 i	1.45–1.55	S
566	75 d	1.14–1.20	S	616	90 E	1.45–1.55	S
<i>FN/LN Disturbed</i>				620	90 d	1.45–1.55	S
617	77 z	1.30–1.35	S	226	95 a	1.55–1.65	S
10	77	1.30–1.35	S	309	96 b	1.55–1.65	D
28	77l	1.30–1.35	S	313	96 g	1.55–1.65	S
120	77 z	1.30–1.35	S	368	95 E	1.55–1.65	S
121	77 v	1.30–1.35	D	440	96 a	1.55–1.65	D
231	77 E	1.30–1.35	S	448	96 d	1.55–1.65	S
314	78 b	1.30–1.35	D	471	61 a	1.55–1.65	S
363	77 b	1.30–1.35	S	568	95 g	1.55–1.65	S
325	77 k	1.30–1.35	S	583	95 b	1.55–1.65	S
398	77 a	1.30–1.35	D	584	185 a	1.55–1.65	S
463	77 d	1.30–1.35	S	114	175 d	1.65–1.75	S
495	63	1.30–1.35	D	115	175 e	1.65–1.75	D
553	77 Ø	1.30–1.35	S	265	68 b	1.65–1.75	S
554	77 n	1.30–1.35	S	295	68 z	1.65–1.75	S
607	77 b	1.30–1.35	S	317	68 E	1.65–1.75	S
611	77 g	1.30–1.35	D	409	68 sT	1.65–1.75	D
230	92 L	1.35–1.45	S	432	68 Ø	1.65–1.75	D
233	92 g	1.35–1.45	S	441	175 sT	1.65–1.75	D
238	92 a	1.35–1.45	S	516	175 d	1.65–1.75	S
267	92 i	1.35–1.45	S	529	175 g	1.65–1.75	S
328	72 g	1.35–1.45	S	544	175 a	1.65–1.75	S
377	92 n	1.35–1.45	S	593	68 d	1.65–1.75	D
390	92 d	1.35–1.45	S	619	68 n	1.65–1.75	S
397	72 a	1.35–1.45	S	636	68 g	1.65–1.75	S
399	72 d	1.35–1.45	S	640	68 a	1.65–1.75	D
461	93 g	1.35–1.45	S	<i>Late Neolithic (4,500–5,500 BC)</i>			
479	93 a	1.35–1.45	D	49	66 n	1.75–1.85	D
483	93 b	1.35–1.45	D	242	66 g	1.75–1.85	S
498	92 b	1.35–1.45	S	244	67 a	1.75–1.85	S
552	92	1.35–1.45	S	50	66 sT	1.75–1.85	S
575	92 E	1.35–1.45	S	254	66 b	1.75–1.85	S
579	92 g	1.35–1.45	D	379	66 Ø	1.75–1.85	D
590	92 sT	1.35–1.45	S	393	66 E	1.75–1.85	S
595	92 Ø	1.35–1.45	D	407	66 a	1.75–1.85	S
601	92 v	1.35–1.45	S	411	66 d	1.75–1.85	S
614	92 m	1.35–1.45	S	466	62 b	1.75–1.85	S
116	90 L	1.45–1.55	S	496	62 a	1.75–1.85	S
122	166 m	1.45–1.55	S	558	66 l	1.75–1.85	S
243	91 a	1.45–1.55	S	587	66 m	1.75–1.85	S

Table 11.3. Inventory of each sample analyzed with the p-XRF, including the samples' unique identifier, depth, period, and potential quarry information (Continued)

Sample	Inventory no.	Depth (m)	Source	Sample	Inventory no.	Depth (m)	Source
618	66 z	1.75–1.85	S	545	168 b	2.60–2.75	S
627	66 n	1.75–1.85	S	391	170	2.75–2.80	S
106	94 l	1.85–1.95	D	433	177 b	2.75–2.80	S
222	94 g	1.85–1.95	S	634	177 a	2.75–2.80	S
229	94 sT	1.85–1.95	S		<i>LN (not secured)</i>		
241	94 a	1.85–1.95	S	629	1467	2.75–3.03	S
249	94 m	1.85–1.95	S	312	173	2.80–2.92	D
274	94 i	1.85–1.95	S	15	179	2.93–3.08	D
315	97 g	1.85–1.95	S	452	1436	3.03–3.08	D
321	94 g	1.85–1.95	S	591	1459	3.07–3.10	S
329	94 g (?)	1.85–1.95	S	245	1415	3.10–3.18	S
332	94 n	1.85–1.95	S	319	1412	3.10–3.18	S
357	94 b	1.85–1.95	S	513	1414	3.10–3.18	S
396	94 E	1.85–1.95	S	273	1399	3.13–3.18	S
474	182	1.85–1.95	D	492	3018	3.13–3.18	D
480	97 a	1.85–1.95	D	527	1457	3.18–3.23	S
493	94	1.85–1.95	D	118	1398	3.18–3.23	S
632	94 g (?)	1.85–1.95	D	125	1397	3.18–3.23	S
550	94 v	1.85–1.95	S	250	1453	3.18–3.23	S
613	94 k	1.85–1.95	S	534	1462	3.18–3.23	D
624	94 d	1.85–1.95	S	615	1454	3.18–3.23	S
53	69 g	1.95–2.10	S	510	1420	3.22–3.36	S
119	187	1.95–2.10	D	531	1403	3.28	S
296	71 b	1.95–2.10	S	107	D16797	3.28–3.30	S
330	69 g (?)	1.95–2.10	S	291	1422	3.28–3.40	D
333	69 E	1.95–2.10	S	454	1438	3.28–3.43	S
392	69 d	1.95–2.10	S	449	1439	3.28–3.43	S
406	69 a	1.95–2.10	S	467	1418	3.47–3.51	S
476	98	1.95–2.10	S	123	D17056	3.70–3.85	D
478	70	1.95–2.10	S	132	A	3.84–3.93	D
504	71 g	1.95–2.10	S	133	B	3.84–3.93	D
555	69	1.95–2.10	S	134	C	3.84–3.93	S
563	69 sT	1.95–2.10	S	135	D	3.84–3.93	D
637	71 a	1.95–2.10	S	136	E	3.84–3.93	D
8	66	1.75–1.85	S	137	F	3.84–3.93	D
500	80	2.25–2.36	S	138	G	3.84–3.93	S
124	80 l	2.25–2.36	S	139	H	3.84–3.93	D
279	30 i	2.25–2.36	S	140	I	3.84–3.93	S
286	80 g	2.25–2.36	S	141	J	3.84–3.93	D
287	80 a	2.25–2.36	S	142	K	3.84–3.93	D
311	80 b	2.25–2.36	S		<i>No depth recorded</i>		
374	80 k	2.25–2.36	D	20	172	1	S
375	80 d	2.25–2.36	S	126	1451	1	S
485	80 E	2.25–2.36	S	127	1444	1	S
569	80 Ø	2.25–2.36	D	221	1447	1	S
112	188 g	2.36–2.48	S	228	1448	1	S
364	81	2.36–2.48	S	272	1394	1	D
290	73 b	2.48–2.60	S	293	163 E	1	S
491	64	2.48–2.60	S	294	140 g	1	S
505	73 z	2.48–2.60	S	306	293	1	S
543	73 g	2.48–2.60	S	316	163 g	1	S
571	73 E	2.48–2.60	S	370	292 E	1	S
633	73 a	2.48–2.60	D	371	292 d	1	S
227	163 z	2.50–2.60	S	408	292 sT	1	S
236	163 a	2.50–2.60	S	428	1445	1	D
395	163 sT	2.50–2.60	S	456	1429	1	S
570	148 d	2.50–2.60	D	482	292 a	1	D
574	163 n	2.50–2.60	S	489	163 b	1	S
625	163 d	2.50–2.60	D	585	1428	1	S
481	168 a	2.60–2.75	S	603	1402	1	D
494	169	2.60–2.75	S				

S = Sta Nychia; D = Demenegaki

et al., this volume), and other sites in Greece, to determine whether similar patterns also can be identified in those assemblages.

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Bibliography

- Arias, A., Oddone, M., Bigazzi, G., Di Muro, A., Principe, C. and Norelli, P. (2006) New data for the characterization of Milos obsidians. *Journal of Radioanalytical and Nuclear Chemistry* 268, 371–386.
- Aspinall, A. and Feather, S. W. (1978) Neutron activation of Aegean obsidians. In C. Doumas (ed.) *Thera and the Aegean World I*, 517–522. London.
- Aspinall, A., Feather, S. W., and Renfrew, C. (1972) Neutron activation analysis of Aegean obsidians. *Nature* 237, 333–334.
- Bigazzi, G., Meloni, S., Oddone, M., and Radi, G. (1986) Provenance studies of obsidian artifacts: trace elements analysis and data reduction. *Journal of Radioanalytical and Nuclear Chemistry* 98, 353–363.
- Cann, J. R. and Renfrew, C. (1964) The characterization of obsidian and its application to the Mediterranean region. *Proceedings of the Prehistoric Society* 30, 111–133.
- Cherry, J. F. (1981) Pattern and process in the earliest colonization of the Mediterranean islands. *Proceedings of the Prehistoric Society* 47, 41–68.
- Cherry, J. F. and Torrence, R. (1984) The typology and chronology of chipped stone assemblages in the prehistoric Cyclades. In J. A. MacGillivray and R. L. N. Barber (eds) *The Prehistoric Cyclades: Contributions to a Workshop on Cycladic Chronology*, 12–25. Edinburgh.
- De Francisco, A. M., Crisci, G. M. and Bocci, M. (2008) Non-destructive analytic method using XRF for determination of provenance of archaeological obsidians from the Mediterranean area: a comparison with traditional XRF methods. *Archaeometry* 50, 337–350.
- Kourtesi-Philippakis, G. (2008) Λιθοτεχνίες και λιθινά εργαλεία από το σπήλαιο της Αλεποτρυπας νοτια, Πελοποννησος (Chipped stone industries and tools from the Alepotrypa cave, Diros, Southern Peloponnese). Unpublished communication during the Colloquium on the cave of Alepotrypa, Diros, 31 March 2008, Athens.
- Kourtesi-Philippakis, G. (2009) Lithics in the Neolithic of Northern Greece: Territorial perspectives from an off-obsidian area. *Documenta Praehistorica* 36, 305–312.
- Perlès, C. (1989) *From Stone Procurement to Neolithic Society in Greece: Text of a Lecture Delivered February, 1989*. Bloomington.
- Perlès, C. (1992) Systems of exchange and organisation of production in Neolithic Greece. *Journal of Mediterranean Archaeology* 5, 115–62.
- Perlès, C., Takaoğlu, T., and Gratuze, B. (2011) Melian obsidian in NW Turkey: Evidence for Early Neolithic trade. *Journal of Field Archaeology* 36, 42–49.
- Renfrew, C., Cann, J. R., and Dixon, J. E. (1965) Obsidian in the Aegean. *The Annual of the British School at Athens* 60, 225–247.
- Renfrew, C. (1969) Trade and culture process in European prehistory. *Current Anthropology* 10, 151–169.
- Runnels, C. N. (1982) Flaked-Stone artifacts in Greece during the Historical period. *Journal of Field Archaeology* 9, 363–373.
- Runnels, C. N. (1985) The Bronze-Age flaked-stone industries from Lerna: a preliminary report. *Hesperia* 54, 357–391.
- Shelford, P., Hodson, F., Cosgrove, M. E., Warren, S. E. and Renfrew, C. (1982) The obsidian trade: the sources and characterisation of Melian obsidian. In C. Renfrew and J. M. Wagstaff (eds) *An Island Polity: The Archaeology of Exploitation in Melos*, 182–192. Cambridge.
- Torrence, R. (1982) The obsidian quarries and their use. In C. Renfrew and J. M. Wagstaff (eds) *An Island Polity: The Archaeology of Exploitation in Melos*, 193–221. Cambridge.
- Torrence, R. (1986) *Production and Exchange of Stone Tools: Prehistoric Obsidian in the Aegean*. Cambridge.
- Tykot, R. H. (1997) Characterization of the Monte Arci (Sardinia) obsidian sources. *Journal of Archaeological Science* 24, 467–479.
- Tykot, R. H. (2002) Chemical fingerprinting and source tracing of obsidian: the central Mediterranean trade in black gold. *Accounts of Chemical Research* 35, 618–627.
- Tykot, R. H. (2011) Obsidian finds on the fringes of the Central Mediterranean: exotic or eccentric exchange? In A. Vianello (ed.) *Exotica in the Prehistoric Mediterranean*, 33–44. Oxford.
- Williams-Thorpe, O. (1978) *A Study of Obsidian in Prehistoric Central and Eastern Europe, and Its Trace Element Characterization*. Unpublished PhD thesis, University of Bradford.
- Williams-Thorpe, O. (1995). Obsidian in the Mediterranean and the Near East: a provenancing success story. *Archaeometry* 32, 217–248.
- Zachos, K. L. (1999) Zas Cave on Naxos and the role of caves in the Aegean Late Neolithic. In P. Halstead (ed.), *Neolithic Society in Greece*, 153–163. (Sheffield Studies in Aegean Archaeology 2). Sheffield.
- Zachos, K. L. (2008) *Ayios Dhimitrios, a Prehistoric Settlement in the Southwestern Peloponnese: The Neolithic and Early Helladic Periods*. (British Archaeological Report S1770). Oxford.

Appendix 11.1. The elemental concentrations provided in parts-per-million (ppm) for each analyzed sample

ID	MnKa1	FeKa1	ZnKa1	GaKa1	ThLa1	RbKa1	SrKa1	Y Ka1	ZrKa1	NbKa1
s08	405.628742	8879.000809	43.320787	15.266939	10.314753	109.467283	112.579942	18.232452	120.425980	9.399416
s10	678.485158	12374.079311	103.544355	19.011082	14.768762	126.225243	122.450421	23.104432	125.619702	10.610265
s15	503.615199	11102.109475	50.148741	14.730495	8.637044	106.490373	127.613986	18.506422	130.901721	10.186927
s20	588.430474	10298.260384	63.841194	15.839501	13.821653	130.223154	128.636789	19.812924	132.357973	11.406110
s23	459.120335	8724.643052	59.592329	15.987378	12.228642	125.706412	121.072477	18.805709	124.292630	10.270872
s28	553.227492	8360.254827	44.699873	15.803800	11.018401	113.084581	113.675261	17.524249	122.804458	10.829742
s41	401.431272	7995.430942	43.532318	15.193104	8.840087	110.225318	110.618740	16.207126	119.285040	10.335384
s47	546.612155	9159.756861	55.150683	15.452765	14.798320	123.457059	120.495396	18.907505	128.518225	10.626733
s49	523.171491	10590.860888	54.464234	16.023007	12.164849	108.678124	134.966251	18.298159	138.210226	9.845097
s50	421.588201	8889.933563	48.249807	15.594180	11.547012	118.911038	115.642029	18.387466	122.285196	9.844602
s52	571.652528	11737.126581	61.135025	15.664090	11.887733	112.554824	134.567590	18.186057	135.229803	9.673494
s53	447.076285	8182.097101	49.219074	15.309735	11.586074	115.632150	118.113843	20.547520	123.501848	10.001657
s106	424.362650	10720.820280	57.258785	15.771049	10.717483	107.624128	130.773305	18.500472	130.625502	10.215736
s107	495.889031	7882.049067	45.406954	15.449703	11.768673	114.313057	112.545654	19.227749	120.163744	10.502739
s112	517.541692	10644.578323	72.713162	17.169104	11.495036	132.034843	127.482515	20.358212	127.183920	10.371680
s114	473.858538	10625.723017	59.666910	15.968064	9.793613	108.051260	111.539251	17.514020	115.843768	9.453380
s115	523.894024	11693.872985	76.054935	16.871253	11.488067	113.162285	140.533247	18.924105	134.053259	9.715895
s116	495.024963	9014.002394	59.246687	16.158831	15.305911	123.227111	121.485535	21.415219	129.824643	9.005797
s118	728.124091	11575.931805	169.650196	25.094129	15.517495	123.769462	127.521265	17.644370	121.857844	11.838826
s119	433.516799	10574.332073	52.121070	15.120724	10.335692	107.325634	134.486067	17.469438	134.570846	9.459593
s120	368.123338	8859.732986	49.727002	15.870041	11.800666	111.083289	106.693101	17.360175	118.028946	9.615357
s121	468.849928	9817.041543	57.313265	16.121363	11.434396	98.498520	123.065851	17.407012	126.741680	9.533066
s122	480.609796	8714.778703	36.536933	14.605192	11.033036	117.661812	116.275593	19.363178	126.134729	11.251095
s123	312.840453	10064.695933	53.834238	16.416059	10.266167	102.486871	126.649887	16.855856	125.856768	9.775513
s124	334.788143	6994.708701	38.708359	15.958288	8.008676	100.592979	98.550030	17.579654	111.261775	9.468892
s125	519.521212	12376.111984	75.620998	17.270614	10.518775	114.417898	105.254088	17.816552	124.385336	9.556000
s126	451.352354	7917.745177	46.750080	15.952180	10.896041	110.195486	112.868965	17.648228	116.855163	9.374744
s127	508.309786	9687.202766	54.958880	16.166976	14.311689	129.537854	121.325745	20.351920	130.021068	10.451278
s132	423.555247	10307.094579	54.595357	16.079634	10.581675	104.667865	129.105787	17.449742	131.020063	9.641578
s133	439.003230	10871.993485	48.125947	15.054214	10.010155	103.868061	129.286206	19.539679	135.755861	9.609218
s134	394.502832	7435.302287	34.891469	14.958956	10.922475	111.542989	111.519638	18.916438	116.187526	9.847713
s135	365.251669	9453.648668	43.033810	14.292603	9.428915	96.424469	121.112795	17.373305	121.002423	9.202459
s136	393.013985	10027.195899	55.226518	15.631818	10.752467	98.659800	120.058681	17.048612	120.607651	9.149748
s137	480.461008	10879.312046	46.863248	14.895750	10.903327	107.740237	134.682214	17.900885	132.833402	8.999857
s138	402.222678	8369.620905	43.151600	14.819000	10.076592	115.952814	107.658032	17.833050	126.259081	10.056195
s139	464.303832	10402.066434	46.447760	14.796651	9.591238	109.391240	132.734052	17.694694	135.474107	8.234146
s140	440.593304	8406.977817	43.341770	15.200199	10.213477	110.064030	111.361463	18.604513	126.129669	10.366387
s141	372.965298	10532.316862	43.130758	14.628820	9.384216	106.446083	129.942312	20.376403	136.388787	9.812057
s142	438.374901	10363.048761	44.738785	15.609057	10.851442	108.748173	132.552646	19.267068	137.034419	9.452810
s221	398.802375	7254.159565	40.002660	15.174359	10.240307	106.781536	106.742886	17.539955	116.302848	9.068620
s222	243.364168	7060.730809	52.011944	15.870550	7.543473	106.552314	97.740248	16.074760	111.485125	8.649059
s225	265.951094	7759.165851	31.781773	14.654433	10.260592	109.058651	104.832138	15.773450	115.840923	9.414573
s226	355.663452	7740.312195	36.600882	14.509088	8.723723	107.647593	105.945628	19.234736	114.967841	9.910917
s227	290.110708	7794.953922	32.647604	14.274329	7.200778	107.606753	105.998824	15.748847	115.798875	9.135168
s228	345.971648	7392.673295	34.991993	14.750367	6.787581	108.562142	93.106571	16.380585	118.484203	9.475862
s229	425.879629	8872.496888	43.460430	14.350119	10.448786	120.146249	112.252476	16.671667	123.734843	9.515148
s230	375.390344	8055.638163	33.075168	13.649783	7.810322	108.040278	104.617696	18.143967	113.051393	11.111536
s231	384.922004	8065.400885	45.172524	14.838433	9.976509	114.036471	109.832450	17.050323	121.216598	8.516384
s233	345.513023	7914.778916	31.253199	13.873851	8.374727	106.448060	104.714236	14.991962	112.193201	8.546213
s236	350.107038	8695.495416	44.461694	15.262689	7.712924	109.322470	107.626396	16.599879	115.048069	8.649780
s238	456.722251	7695.069700	33.866347	14.332773	9.433074	106.058485	106.081569	17.167140	117.413480	10.668191
s241	398.151410	9041.641225	62.254662	15.985493	11.946916	113.114940	114.700857	18.265039	118.169953	9.164499
s242	394.662628	7662.916293	28.916093	13.829336	9.808521	114.194262	112.194389	18.570241	121.329232	8.547625
s243	275.094850	7425.702248	38.057539	14.403037	7.432123	96.610647	93.292989	18.412711	106.279828	10.069570
s244	341.637282	7969.294050	42.384439	14.659386	12.611999	109.831836	111.914596	19.234430	118.245136	7.780824
s245	350.363802	7775.576387	51.836690	15.891191	7.157266	113.380614	105.218200	15.501483	115.726577	9.395303
s247	401.287695	7717.380200	32.526392	14.326681	9.800580	108.070794	102.761916	17.045742	117.150525	9.195895
s249	344.029730	7978.047655	33.651122	14.659204	10.764071	112.472309	110.085399	15.440125	118.113716	9.802969
s250	343.121416	8275.780648	42.274357	14.812283	10.802159	116.576792	111.574017	17.056113	121.079953	9.549163
s254	367.670168	7850.032438	28.427115	13.976778	10.206595	113.117970	107.548710	16.169971	115.824524	10.632721
s261	391.763213	7670.486230	26.712787	14.190005	8.042834	107.294788	106.284141	15.691568	113.739522	9.881362
s264	333.041837	7614.909184	42.817242	14.870524	9.478532	106.396916	105.766732	16.977240	111.207245	11.021162

(Continued on next page)

Appendix 11.1. The elemental concentrations provided in parts-per-million (ppm) for each analyzed sample (Continued)

ID	MnKa1	FeKa1	ZnKa1	GaKa1	ThLa1	RbKa1	SrKa1	Y Ka1	ZrKa1	NbKa1
s265	393.458387	8107.453035	33.559094	15.106883	10.111997	106.205682	105.104635	17.767852	120.539407	9.354465
s267	355.104478	8658.321663	38.266652	14.111996	8.255226	111.262636	105.173234	15.451062	116.916316	9.785723
s268	382.248455	8068.581491	63.781065	16.298415	9.796271	106.527837	100.990404	16.478979	112.468941	9.526298
s272	400.104335	11097.975818	61.003495	15.420708	7.958193	107.870953	134.860759	18.327753	129.410978	10.952241
s273	271.077018	7522.502751	36.322182	14.282882	8.559588	106.122068	100.689538	15.085537	113.869167	9.507956
s274	389.889529	7568.778883	32.203510	15.081917	12.475881	109.433431	105.608607	18.163974	112.497914	9.733784
s279	390.809027	7935.078467	31.173691	14.347506	10.372771	106.725447	105.645650	17.016263	111.180610	11.291245
s283	317.098576	9886.452425	41.681561	14.497473	7.773307	106.320995	122.160077	16.594702	120.458150	9.969129
s285	330.681949	10145.988227	44.636545	15.434111	9.542679	97.782885	120.309690	18.524741	123.759733	9.072151
s286	424.416151	7616.654553	30.619475	14.648789	8.538554	114.333294	106.937560	16.304165	115.318271	8.855999
s287	293.801646	7758.091414	32.968044	14.251501	9.093489	110.428363	110.936283	19.324741	118.819599	8.692824
s290	355.566610	7506.623981	27.133695	14.205273	9.525393	111.174596	105.966489	17.270428	117.898598	9.871076
s291	328.792478	10208.809748	57.362055	15.766943	8.964334	103.967208	129.107632	19.583512	129.050900	9.404086
s292	367.265780	7153.079192	32.712523	14.410739	9.564770	99.191784	94.197562	17.713247	112.081644	9.001019
s293	379.841141	7584.664159	35.531557	14.344163	8.857126	102.079575	103.059178	16.404689	112.750879	8.391821
s294	370.636267	7993.499769	32.189416	14.281094	9.573841	112.911813	112.600035	17.765645	119.423341	9.198837
s295	331.230829	7891.172031	30.194343	13.748092	8.549438	111.226129	105.479008	17.780714	119.619999	9.402277
s296	397.399445	7280.180922	29.736105	14.467984	7.577285	111.738980	106.765248	17.815486	117.807389	9.198084
s297	326.209736	7857.764272	28.551853	13.616305	10.288688	106.065433	103.371811	17.561517	115.054613	10.365436
s299	273.354882	7495.837589	31.565845	14.685544	11.217369	103.821399	106.607263	16.674018	110.702525	9.968809
s301	553.189426	14142.835198	63.718651	15.383627	8.533915	109.037589	132.140198	17.596328	130.196352	9.828511
s302	385.960032	10922.513014	67.649837	16.214733	9.764809	104.563036	132.483999	18.052812	125.847981	9.054624
s306	409.994417	8447.943060	44.673071	14.963519	8.868877	110.349243	108.434885	15.822540	116.041737	10.281089
s309	418.200454	9489.535763	54.698356	16.034658	9.509891	100.088044	116.110278	15.908568	124.852561	8.807703
s311	391.117272	7324.116008	49.123891	14.649595	7.459420	96.201793	99.629112	16.080799	110.874229	8.705548
s312	435.168416	9693.486275	41.862480	15.090224	9.530572	102.826152	125.379831	19.039360	126.799499	9.420802
s313	389.366970	8042.964642	34.130430	14.690298	10.884816	106.612066	107.618803	17.773511	116.684389	9.694105
s314	420.048610	9640.166859	34.486446	14.867431	10.323452	103.276014	129.300426	17.387046	125.720382	9.888959
s315	354.000855	7913.729833	34.959022	14.926511	10.910476	109.004368	111.835689	17.006050	119.006975	8.792220
s316	332.205475	7772.849820	37.304671	15.198685	8.892133	103.320120	105.070601	17.568238	112.916521	7.930245
s317	344.614792	7422.572959	40.753255	15.751763	10.860580	113.100216	104.234646	16.105013	119.698257	10.079220
s319	417.996847	7649.914877	51.070332	15.772306	10.840787	110.454288	111.629966	17.186858	118.609688	10.229972
s321	381.570981	7561.359127	27.262674	14.080589	10.200414	102.404401	109.015835	16.557450	111.930986	9.198192
s325	334.648347	9092.242173	36.633670	14.374447	8.644220	119.700253	113.931142	20.647031	124.452668	9.140627
s328	369.053486	7918.896904	31.276701	13.794357	11.424438	109.943899	107.465658	17.407798	119.310167	8.898158
s329	419.096990	7970.198842	31.950089	14.666213	9.041456	116.617479	117.309087	18.111221	119.823301	10.611414
s330	410.122595	8478.341398	50.646849	15.530841	10.915896	105.292615	104.674090	17.301531	114.415238	9.836587
s331	443.591107	9793.430853	32.500339	14.703959	7.944176	95.943219	117.657232	17.707102	126.995921	9.682555
s332	406.993526	7468.353101	36.557916	14.653515	7.968400	102.695903	102.239475	19.326458	113.689186	10.413421
s333	304.009931	7959.335812	35.994092	14.108393	9.151827	114.561082	115.336683	18.934828	121.859199	9.352991
s357	389.304834	8143.788196	48.779374	15.930543	11.366902	119.446071	112.227864	18.783728	120.730942	11.171006
s362	382.159745	9815.181392	42.832199	14.787746	7.567513	99.098130	118.391001	17.123333	123.261626	9.472508
s363	319.530006	8660.528092	46.796816	15.519229	9.957736	111.631813	113.735637	18.731642	113.643866	10.361520
s364	368.849367	7838.051782	27.217854	14.454110	9.858371	106.066312	107.126154	16.691610	115.744620	10.288929
s368	372.289853	8604.653113	43.698821	14.877996	9.389031	114.626462	112.800247	17.214199	118.331939	9.033145
s370	306.419030	7824.117841	41.320344	14.438270	7.256164	96.845185	93.806005	14.779373	103.150194	9.108386
s371	493.174351	8475.228092	37.138670	14.577436	7.421275	119.774892	122.851229	17.994455	121.717607	9.981537
s374	296.813244	9561.658076	30.488246	13.996435	7.444679	99.415420	117.638697	16.867892	124.952435	8.705173
s375	364.771209	7561.003919	32.747845	14.482366	9.392907	110.293606	110.002487	17.647210	120.734613	9.971464
s376	365.579687	7518.999731	36.370962	14.441361	8.675410	108.018930	101.829092	18.646189	117.330574	10.039977
s377	290.525376	9220.372019	32.156218	14.824119	9.147574	104.799806	98.491247	18.992934	114.884148	9.134151
s379	474.330986	10468.231146	68.920205	16.791055	7.613414	112.034948	132.107672	17.512504	131.571160	9.448866
s390	327.388684	7781.502926	36.103604	15.137731	9.369813	111.570218	108.611955	19.353878	119.129732	11.010262
s391	407.983463	7714.722917	29.857320	13.915572	10.714543	108.835334	113.057797	16.835379	116.384375	9.091404
s392	338.135712	7667.603789	30.465859	13.957231	9.130804	110.085001	106.494623	15.979121	118.363871	9.328946
s393	392.375986	7732.645813	31.504278	14.871045	9.439883	108.983458	109.186058	17.077392	118.618794	10.925304
s395	390.140617	9113.613837	39.976380	14.489204	9.754552	111.104907	113.822461	17.796271	118.309995	10.004279
s396	245.046543	7625.902235	33.307393	14.909545	9.565163	112.278289	109.925953	18.173711	120.652143	10.161822
s397	419.698210	7589.451381	32.261210	15.036792	9.688384	104.916418	107.130673	18.031295	117.267336	9.185549
s398	394.048993	10284.701670	38.374520	14.513171	8.238142	96.340889	114.755076	17.456436	128.328830	9.883132
s399	350.622605	7731.570355	35.312459	15.176346	8.132654	116.373017	112.596083	17.926031	123.643416	8.375753
s404	404.174945	8104.526468	36.024207	14.980376	10.535820	111.108198	107.969175	18.550955	115.538956	10.862870

Appendix 11.1. The elemental concentrations provided in parts-per-million (ppm) for each analyzed sample (Continued)

ID	MnKa1	FeKa1	ZnKa1	GaKa1	ThLa1	RbKa1	SrKa1	Y Ka1	ZrKa1	NbKa1
s406	349.160947	7135.953669	32.799021	14.333958	9.505051	107.423801	103.175052	17.683370	114.552822	8.095751
s407	367.275481	7394.574813	30.450894	14.383307	9.576233	102.502143	101.984667	17.810505	112.938864	9.117409
s408	357.988748	9378.147656	65.788586	16.777344	11.327827	109.263339	111.116859	15.169365	118.923373	9.792997
s409	382.394313	9632.241291	36.341146	14.371476	11.351327	103.246245	131.736872	17.670359	127.687345	10.020904
s411	407.419638	8341.184554	30.539416	14.291617	11.529297	110.106090	105.859197	16.985391	118.419506	9.713875
s428	232.035267	10575.335111	63.414938	15.945262	8.192933	97.696378	121.768604	16.479942	126.204264	7.941881
s432	341.069351	9428.927572	45.045087	14.873640	9.119477	94.669536	113.958543	15.923240	120.339176	8.582610
s433	364.689783	7519.520770	32.467684	14.851858	10.659804	114.061455	104.784656	18.916913	119.909487	9.974114
s440	374.218507	13217.041123	48.172092	13.675163	9.080175	96.195539	97.455048	16.021365	119.086038	8.811738
s441	593.029985	13621.388095	188.203741	23.659471	11.478457	118.989387	145.544296	18.090135	125.229671	9.452329
s448	396.137027	8419.563184	38.244047	15.140505	9.608807	115.554827	112.816452	18.162130	116.324617	10.030622
s449	330.324771	8859.962183	72.256834	16.077079	10.585782	117.563110	117.579004	17.779731	119.302823	10.449830
s451	394.730853	7615.336378	32.948082	14.712838	8.422209	103.448677	96.550406	19.311223	115.475309	9.080922
s452	395.419364	10865.158510	90.317711	17.020729	9.074050	109.911244	133.827559	17.595767	129.889693	10.895980
s454	315.857296	8272.365302	69.853195	16.504050	8.751332	113.959989	119.731831	17.208873	119.066770	11.470386
s456	357.692144	9600.038666	53.439927	16.382686	9.178458	110.048876	105.862942	16.009363	121.444901	10.279796
s457	379.688028	11190.289076	70.823208	17.468336	8.506199	111.003091	131.073546	18.083019	128.261979	10.305477
s461	356.033400	8654.544013	44.225957	14.578628	10.968460	120.867569	119.034443	17.840226	122.191734	11.052460
s463	284.997938	7880.364574	40.899602	14.085513	7.422678	100.560043	101.968080	16.166172	111.271248	9.278105
s466	340.890174	7432.770113	32.812639	14.444725	8.518368	106.870165	104.213949	15.580245	112.721866	9.380482
s467	311.846996	8668.363682	42.826964	15.193343	10.224147	105.298065	112.603185	20.576802	113.099868	8.947132
s471	345.815252	7721.794475	24.325263	13.676756	7.760717	104.079605	98.291796	15.048557	110.224314	8.978312
s473	428.723809	8542.293742	41.629844	15.171087	13.036333	116.071051	115.772196	19.394967	121.169808	8.894292
s474	382.199392	9965.663385	36.617763	14.177499	7.605218	106.319391	125.104210	15.918640	120.286983	7.928113
s476	403.375152	7276.188958	49.508431	15.538278	8.769724	106.471512	102.872204	18.705246	116.598559	8.906206
s478	235.449415	6688.734902	20.765087	13.749924	7.883054	103.408323	107.939287	16.189978	113.972251	8.673936
s479	361.552375	9619.508918	35.689186	14.370504	10.456276	102.104542	128.773814	18.164859	128.498154	9.949546
s480	353.963253	9097.408982	38.518821	14.641965	7.419967	100.722451	120.903791	14.238798	126.738470	8.422004
s481	432.556750	7354.432441	23.387777	13.312582	8.568072	112.484540	102.810452	15.073570	120.880377	8.669597
s482	579.298578	19606.428273	70.143827	15.523976	9.921525	106.096835	103.288442	19.59414	122.804129	9.518106
s483	385.499782	9795.181159	31.028196	14.702545	8.513880	101.248180	123.867247	16.155965	126.652140	8.598742
s485	283.401393	7474.118961	28.954545	13.733402	9.817304	105.939241	101.036440	17.909813	112.065924	8.286895
s489	309.367067	7352.821184	32.001468	14.920588	8.641098	106.064394	101.513626	16.972512	111.912664	8.649245
s491	374.430609	7281.725999	24.270230	13.903650	10.833087	108.861742	101.088352	15.470922	113.403477	8.553242
s492	388.553921	9907.933134	41.048621	14.630960	9.822850	93.572011	110.975022	15.552322	119.118299	8.029359
s493	386.316250	9534.791186	34.867400	14.288613	6.572627	102.967737	120.909816	16.408092	127.075837	10.098435
s494	381.712625	7430.383584	32.532378	14.853449	10.105807	108.809082	111.010171	16.521465	114.756945	9.217683
s495	304.572204	9281.904651	42.078380	15.382705	8.986363	94.734231	115.885497	16.704264	118.170454	8.367481
s496	388.866243	7542.310130	28.165882	14.254270	10.051417	112.971397	101.696528	15.807257	114.217527	9.923020
s497	385.398116	8777.915658	46.704777	15.030226	9.018130	94.914827	111.605670	13.016511	117.374671	8.763156
s498	406.443676	8002.443254	32.640208	14.326209	9.485330	109.190680	107.993227	16.179067	112.947087	10.201327
s500	284.158146	7489.267683	36.122727	14.043337	7.913769	106.743557	110.208607	15.786781	112.554798	9.578469
s504	446.075186	8187.380150	36.451434	14.814967	9.634021	110.272253	109.250398	18.771879	113.790399	9.994470
s505	344.474002	7693.799956	31.849779	14.300479	8.451359	100.496533	101.234703	15.427154	111.101016	8.686990
s510	537.255318	11125.732043	175.128474	24.119699	13.602950	127.557846	124.549217	17.770857	123.111557	11.455521
s511	437.007706	8202.613011	71.322792	17.597297	9.336564	111.883694	110.486444	15.563092	120.561831	10.539629
s513	351.206674	8480.428092	83.122772	16.957208	7.658834	113.322335	108.515905	16.983180	116.583829	10.437943
s516	464.685556	9916.063292	110.736543	18.903908	11.654771	125.828917	126.849417	18.045079	124.132189	10.902846
s518	367.894585	9094.012111	70.121403	16.694032	11.527849	118.951735	117.127944	18.498138	114.124844	11.632252
s519	429.587776	9032.941229	70.983050	16.600672	11.132860	118.371031	118.541986	14.370152	119.722089	10.374428
s524	314.035409	10200.554003	51.565748	15.369210	6.502281	90.790934	115.832900	18.076142	120.335765	8.841202
s527	323.103396	8599.950485	43.563235	14.953852	9.631214	118.386838	116.684642	17.162401	120.074104	10.948100
s529	500.411014	9654.670627	125.847942	20.404134	12.233062	127.259232	127.987367	17.465654	126.391266	10.821444
s531	439.765297	8785.413757	50.457642	15.615432	10.504136	123.715241	120.800800	19.190892	128.342538	10.193686
s534	367.416993	10841.288430	61.563912	16.242145	10.522988	112.155649	132.022808	16.425059	129.737436	9.031032
s535	436.206158	12802.296815	93.713794	18.263880	9.359610	116.307197	130.847876	17.241465	130.564147	8.273225
s536	372.304182	9283.680256	90.666735	17.306528	13.997878	127.204354	124.586278	16.891244	123.306825	9.288386
s541	442.094007	8248.918832	32.716667	14.239550	9.344553	113.864531	113.538511	18.042024	120.285035	10.173405
s543	238.355944	7580.310519	31.504081	13.796341	9.508042	106.283658	104.504349	17.055043	113.023621	8.885797
s544	485.858316	8297.004994	37.731615	14.098580	11.301892	114.945213	108.427351	17.294218	118.847556	9.511968
s545	388.805098	7700.444569	32.885801	14.578760	8.300376	109.762867	106.177738	18.466854	119.194098	9.310818
s546	372.205898	7925.062798	46.690863	15.534479	9.926597	104.280742	106.965666	17.352315	115.485332	9.357881
s548	484.616245	11173.684841	53.537532	15.046794	8.497762	104.260546	130.477721	18.349009	131.124610	9.236588
s550	334.335173	8213.877404	31.783170	14.531359	7.448491	106.788480	110.776567	15.406268	119.876572	10.428216

(Continued on next page)

Appendix 11.1. The elemental concentrations provided in parts-per-million (ppm) for each analyzed sample (Continued)

ID	MnKa1	FeKa1	ZnKa1	GaKa1	ThLa1	RbKa1	SrKa1	Y Ka1	ZrKa1	NbKa1
s551	373.677053	8895.980043	53.776061	15.582634	10.495839	120.302380	115.232566	17.855582	117.653926	10.517460
s552	322.832921	7909.573781	29.108043	13.816077	9.596106	104.253257	113.958294	17.295811	116.323616	10.728092
s553	381.646121	9932.122831	55.685322	16.005266	9.206312	118.007080	115.801276	17.612631	117.298363	10.358081
s554	410.695066	7912.513324	49.396169	15.431318	10.008704	110.229152	103.801536	19.491639	121.591353	9.383486
s555	432.117606	8128.561200	40.445720	15.041667	10.235965	111.983297	108.990540	20.499676	122.583940	8.991852
s556	369.756325	10761.650164	110.266856	18.568384	8.364005	104.811883	122.715636	16.815481	126.287781	8.175099
s557	341.368959	10581.377041	49.776255	15.414657	9.517054	116.171261	111.826488	17.006940	115.962273	9.548141
s558	312.771143	7698.344037	35.519546	14.528218	9.670210	107.328578	105.784077	17.208011	115.746921	9.628657
s561	331.277213	7937.865447	42.022335	15.315807	8.437541	113.971473	102.379553	18.154333	118.297588	10.423151
s563	367.026615	9118.959523	52.551310	15.132006	9.385759	110.278546	109.626627	22.238401	114.953795	9.154245
s566	354.939247	8377.308214	46.135228	15.176317	8.878347	114.726120	116.151389	20.484678	117.103856	9.075004
s567	374.451263	7857.233261	45.549449	15.070745	11.951071	107.928981	106.733253	19.318329	116.820408	10.027889
s568	345.737416	8440.578814	37.446093	14.758630	10.541550	117.294492	110.724086	17.380534	114.580468	10.030914
s569	332.257201	10451.291336	47.356930	15.155263	7.730262	114.093434	126.548511	14.388429	133.632340	9.675724
s570	347.464104	10195.791927	40.675320	14.830703	9.661983	102.761483	126.238714	16.942920	127.917270	9.283390
s571	348.995061	8029.454931	33.222917	14.490089	9.837754	114.655176	107.150462	18.165871	120.660644	11.742522
s574	367.031469	9144.974613	48.209868	15.453073	12.233433	117.664547	117.738343	17.266770	122.398379	8.518782
s575	287.993813	8444.253287	42.294431	14.987370	9.739994	110.626141	106.370407	18.080136	117.858254	9.777869
s579	386.397312	10859.991788	42.197210	14.667270	6.134155	104.974557	123.308444	18.065511	126.424272	10.170045
s583	396.037852	8013.815935	34.855532	14.297561	11.077459	109.441408	109.724456	19.433036	119.903352	9.086607
s584	324.630398	8501.326158	71.878194	17.329683	10.560356	116.743865	114.044169	18.173674	122.273687	9.353174
s585	325.222489	7449.765375	59.603397	15.622394	8.866019	101.601976	101.805694	17.341535	112.529059	8.697834
s587	359.324566	9095.259199	437.652122	37.584720	12.755248	116.987687	121.584622	17.151781	119.308057	9.504884
s590	386.139018	8372.979307	44.980638	14.893470	7.071250	111.028700	112.554452	16.372630	118.564832	11.140921
s591	326.929143	7754.909486	34.849029	14.402701	9.826934	104.944690	105.159592	17.309063	115.843008	7.795556
s593	404.341303	9983.762117	40.009742	14.313213	11.319698	106.967272	128.449707	18.739002	129.517491	9.615296
s595	355.332464	9643.711591	45.457666	14.302922	8.699292	98.632732	123.332176	17.710979	125.054910	10.474418
s598	405.183700	10167.822201	37.282877	14.913318	12.562629	110.052078	114.818374	18.345856	119.182934	9.522878
s601	301.817270	8531.446766	25.947733	13.519044	9.274375	105.232342	108.073899	16.462169	119.110538	9.952977
s603	402.326494	10268.908017	52.269092	15.266350	8.654749	105.616432	120.526712	17.578834	130.168645	11.499888
s607	341.022167	8078.864024	39.761934	14.394444	9.654077	114.675070	112.368244	18.910092	122.869498	9.054643
s611	296.071828	10475.542159	48.024768	15.479936	6.785436	103.477313	118.180128	16.238356	127.673222	8.778703
s613	331.732077	7898.691104	34.364881	15.430333	10.106591	118.375740	109.276094	16.353592	120.727152	10.471420
s614	381.924678	9127.146954	43.353392	14.653705	10.952367	113.171567	108.093676	19.716201	113.350672	9.730367
s615	382.200306	7789.651454	34.786935	15.076217	11.333046	100.782142	102.898910	18.937523	115.621307	8.943808
s616	470.458183	8880.379349	32.935748	14.145693	9.058827	106.484137	108.501897	17.436716	120.160841	9.183801
s617	418.651944	6750.005575	31.693785	14.367093	6.991068	95.789084	92.413431	17.964488	102.873864	9.339988
s618	397.200466	8285.433722	39.001261	15.026033	9.940068	103.929700	105.788691	21.692120	115.907897	9.137837
s619	358.552640	7398.516757	27.192115	14.163105	7.837023	108.493483	112.371970	18.326377	113.664877	8.981526
s620	339.281892	8135.621902	38.275233	14.366235	9.807701	112.455845	113.582972	16.464257	114.165982	10.239571
s624	415.790014	7417.286284	38.031591	14.738918	9.214038	106.404535	103.484300	16.106245	119.797548	10.646201
s625	330.131265	10070.970465	37.137496	15.016915	8.214326	98.654123	120.749257	17.870421	124.054710	8.682453
s627	419.358891	8273.954332	41.260710	15.131563	11.132684	120.555237	110.133868	18.002750	123.497918	9.761372
s629	340.786521	7450.338724	35.203249	14.482241	9.159027	103.001668	102.045332	17.613738	111.862356	8.806756
s632	387.258103	9948.802196	41.536023	14.856108	8.158699	95.437678	114.433913	17.081319	124.521617	8.845348
s633	392.381663	10680.887385	70.107383	16.765441	10.810810	103.581837	123.058861	17.723910	126.526666	9.411693
s634	445.038213	7418.382128	33.787838	14.530913	10.755470	108.679035	102.717639	16.428379	119.759095	9.814970
s636	304.786185	7778.374514	37.368119	14.104798	10.161070	113.676881	108.826963	18.717021	124.318198	8.686374
s637	384.018051	7256.513506	42.312466	14.901578	7.386179	103.423108	105.203742	17.768843	112.331858	8.867866
s640	414.773337	9753.088308	43.995803	14.182979	7.373053	96.373043	127.760315	17.282473	124.235658	10.384193

Neolithic bone and antler artefacts from Alepotrypa Cave

Georgia Stratouli

Synthesis of material

The assemblage of bone and antler artefacts from the Neolithic deposits of the excavations at Alepotrypa Cave comprises approximately 116 artefacts. The vast majority of these, c. 73% of the assemblage, were used for the modification and manufacture of materials, meaning they are tools. The assemblage includes mainly *pointed implements* (65 specimens), a few *needles* (nine) and *edged implements* (12), as well as some *parts of composite tools* (two items). In addition, there is a small number of other finished objects, *i.e.*, a total of six artefacts made from bone and antler, such as pendants (see Katsipanou-Margeli 2011, 137, no. 82; Papathanassopoulos and Katsipanou-Margeli 2011, 215, no. 162), and/or fragments of perforated pieces of unclear nature. Lastly, 25 fragments of finished artefacts, c. 22% of the assemblage, remain unidentifiable.

The tools

Tools with pointed tip

These are the dominant bone tool category within the assemblage from Alepotrypa Cave. Bones, primarily the long bones and in particular the metapodials, are suitable for modification into pointed artefacts (see for example Stratouli 1993, 497–507; 1998, 43–92; Christidou 1997; 2005, 93–99; Legrand 2005, 108–111; Sidéra 2005, 85–87). These are objects that make contact with a small part of the material being processed initially through pressure, direct or indirect percussion, being then further able to be worked via rotation or (usually) semi-rotation. Such tools are commonly called awls, *i.e.*, implements used for the perforation of dense materials, such as hides and leather, or the bark of trees. Moreover, their use is widespread in basketry, matting, and weaving.

In Alepotrypa Cave, the category of tools with a pointed tip is represented mainly by four techno-morphological

groups on the basis in part of the raw material (by anatomical part and animal size) that was used for the manufacture of the tools and by the degree of the raw material's modification (14 undetermined fragments of pointed artefacts remain). In particular these categories are:

1. Pointed implements on unsplit shaft fragments, predominantly of sheep/goat-sized long bones (c. 41% of the classifiable pointed tools): mostly metapodials and a few tibias, preserving one of the bone joints (epiphysis) at the base of the tool (Figures 12.1 and 2).
2. Pointed implements on unsplit shaft fragments of small animals, preserving one of the bone joints at the base of the tool (eight specimens, or c. 16% of the classifiable pointed artefacts): distal and proximal parts of hare tibias and a specimen on a carnivore fibula (Figures 12.3 and 4).
3. Pointed implements on split long bones, mainly of sheep/goat-size, preserving part of one of the bone joints at the base of the tool (14 artefacts; Figures 12.5 and 6).
4. Pointed implements on splinters of bones (*e.g.*, long bones, ribs) without preserving part of the bone joints at the base of the tool (four specimens; Figure 12.7).

Manufacturing techniques

For the partial modification of the shaft of long bones (*i.e.*, removal of portions of bone) and the longitudinal division of metapodials, the techniques selected were time-consuming, though thereby the outcome was perfectly controlled (see Legrand 2005; Sidéra 2005, 85–87, fig. 8). The following manufacturing techniques are recognisable in the material under study:

- abrasion and grooving-and-splitting, for the controlled removal of bone parts or the division of the bone;



Figure 12.1. Pointed tool from unsplit sheep/goat s/g-metapodium, $\Delta.3$ (L. 11.2 cm).

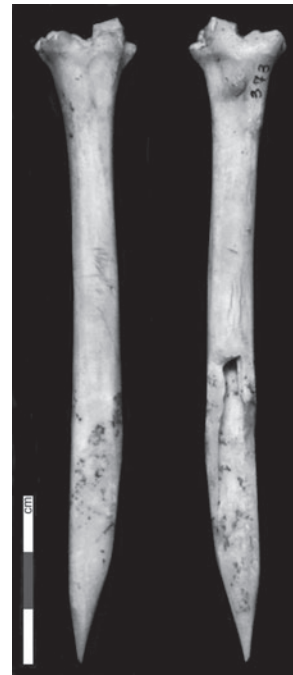


Figure 12.3. Pointed tool from unsplit hare distal tibia, $\Delta.373$ (L. 11.4 cm).

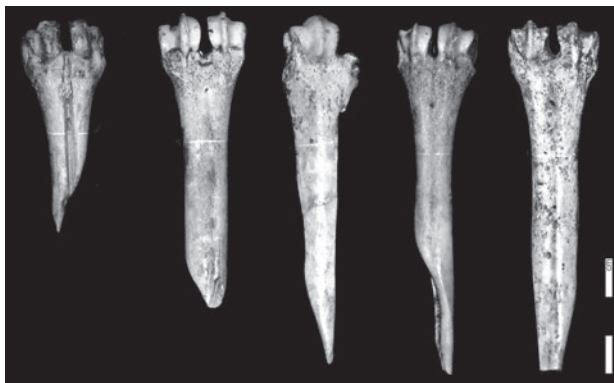


Figure 12.2. Pointed tools from unsplit s/g-metapodials, $\Delta.382$ (L. 5.6 cm); $\Delta.133$ (L. 7.8 cm); $\Delta.253$ (L. 9.6 cm); $\Delta.1812$ (L. 9.3 cm); $\Delta.132$ (L. 9.4 cm).

- bilateral partial grooving-and-splitting of the shaft (diaphysis) of the long bone and final detachment/division using wedge and indirect percussion;
- grooving-and-splitting only.

Tool use

The techno-morphological categories 1–4 mentioned above comprise tools that have a range of forms in the working part: some points are extremely thin and sharp (diameter <2 mm), while other are clearly more robust. The size of the active parts of the tools discussed here, as well as the macroscopic observation of the use-wear traces on them, show that these artefacts acted as perforators for hides and leather, and generally of compact materials. They could also serve in working other types of material,

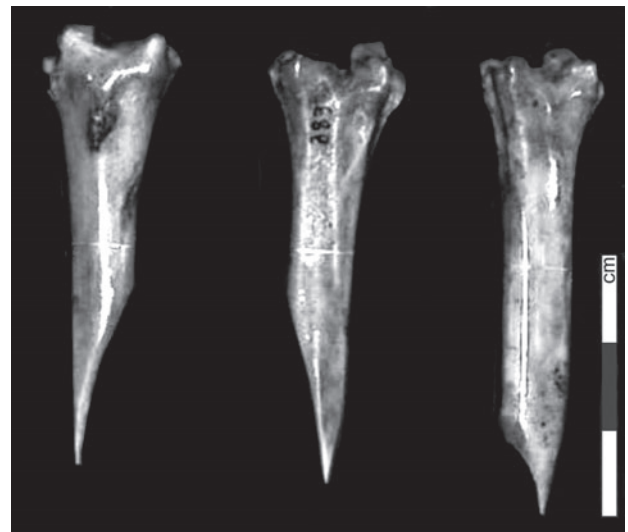


Figure 12.4. Pointed tools from unsplit hare proximal tibias, $\Delta.383$ (L. 5.2 cm); $\Delta.379$ (L. 5.3 cm); $\Delta.24$ (L. 5.5 cm).

perhaps basketry and/or matting (Campana 1989, 54–59, 67–71; Gates St-Pierre 2007, 109–116; Legrand and Sidéra 2007).

Several of the pointed tools under discussion seem to have been exhausted; they represent debris after breaking, or are the result of processing/modification-re-use/recycling, typical of artefacts with a long life-cycle.

Needles

After the abundant assemblage of needles from the Neolithic deposits of Tharrounia Cave (Stratouli 1993),

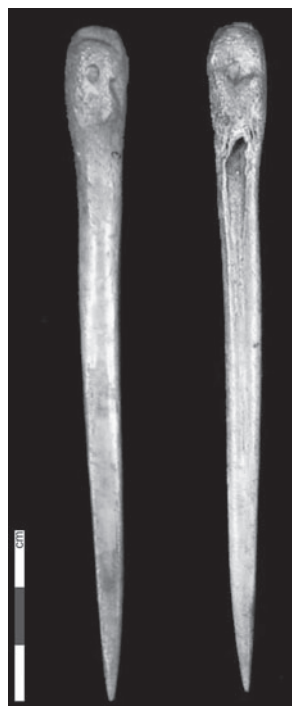


Figure 12.5. Pointed tool from split s/g-sized metapodium, A.2 (L. 12.2 cm).

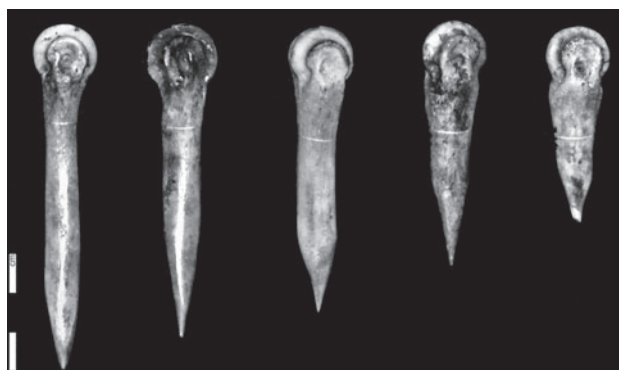


Figure 12.6. Pointed tools from split s/g-metapodials. A.134 (L. 7.9 cm); A.5 (L. 7.3 cm); A.397 (L. 5.7 cm); A.380 (L. 6.5 cm); A.374 (L. 5.0 cm).

Alepotrypa provides the next most numerous corpus in Neolithic Greece. They comprise tools with a pointed or rounded tip and hole for inserting and binding the thread at the other end (Katsipanou-Margeli 2011, 127–132, nos 72–77). These objects are currently a chronological ‘marker’ for the Late Neolithic (LN), in particular for LN Ib and LN II¹ (including FN, *i.e.*, c. 4800 cal BC; see Stratouli 1993, 507–511, figs 8–9; 1998, 93–100).

These are artefacts entirely processed out of thin/fragile blanks from bone splinters, themselves frequently of ribs of large mammals (*e.g.*, cattle) and rarely of red deer antler (Figures 12.8–12). They demanded specialised handling to produce, requiring increased levels of technical knowledge and skill on the part of the manufacturer.

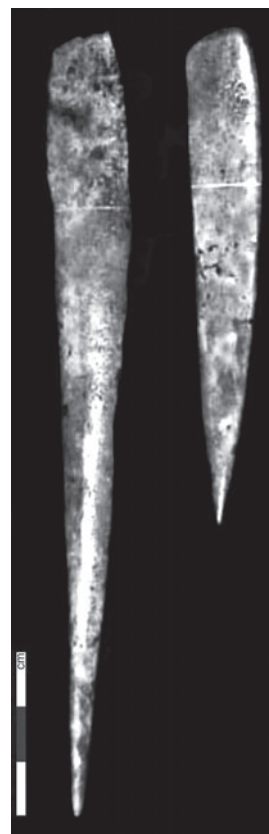


Figure 12.7. Pointed tools from bone splinters, A.266 (L. 14.4 cm); A.12 (L. 9.2 cm).

In most pieces, the ‘eye’ of the needle has been perforated, while in a few examples it was opened by the technique of bilateral grooving. Based on the small size of this eye, which ranges from 0.8 mm to 2.2 mm in diameter/width, it is safe to conclude that the thread employed was correspondingly thin, approximately 1–2 mm across.

The size (in terms of length and width) of the objects varies, from large specimens >20 cm to quite small ones <12 cm in length: this range indicates different intended uses. A high degree of use wear, all along their lengths, is expressed as considerable polishing and thereby the forceful obliteration of manufacture marks: this suggests the objects were in contact with relatively soft materials, of a rather non-dense structure. The tools most likely were used in allied tasks, for example in knitting, matting, or netting.

Tools with transverse sharp or rounded active edge

These are few in number, and mostly preserved in fragments. The raw material for their manufacture was obtained from partially or completely lengthwise split ribs of large mammals (Figure 12.13). Wear marks, such as extensive rounding of the edges from abrasion and intensive polish with striations perpendicular to the active

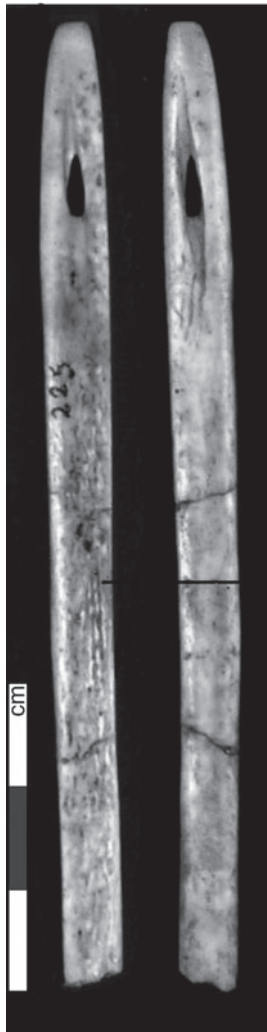


Figure 12.8. Needle from split rib, $\Delta.225$ (L. 9.6 cm).



Figure 12.9. Needle from antler splinter, $\Delta.245$ (L. 8.1 cm).

edge, show they were likely to have been used as scrapers/cleaners for removing the fat from the insides of hides, and/or of wooden vessels (Campana 1989, 119–121; van Gijn 2005, 51–53).

Parts of composite tools

The characteristic artefact of this category at Alepotrypa is that of a tripartite tool (Figure 12.14). It is a basal segment of a shed red-deer antler ($\Delta.35$ from the deposits of Chamber B; length 11.6 cm; width 6.1 cm). It has two sockets cut into it: one, placed at a right angle to the long axis, was used for inserting a wooden haft/handle; the smaller socket in the transverse end of the beam received a small ground stone tool with sharp edge (*e.g.*, an axe or adze).

Artefacts of this type are representative of the Late Neolithic II (LN II). The replacement of part of the wooden tool by antler is considered as a technological improvement (Lyneis 1988, 305–308; Stratouli 1993, 524–525, figs 17–18, and 1998, 176–181, figs 14, 15). This is because antler – being a quite elastic material –

absorbs the stresses of percussion, thus extending the life of a portion of the composite tool.

Material readings

Correlation of the morphology (the forms) of the artefacts with the raw material (the anatomical parts) used for their manufacture suggests an excellent knowledge of the properties of the materials and their efficient management for optimal results.

The raw materials (mostly from domesticated sheep/goats) are totally in keeping with a rural Neolithic community, which also practised the hunting of wild animals, as well as the gathering of discarded deer antler.

Most artefacts appear to have been fully formed when transported into the cave; they were not manufactured there. The majority of the artefacts under discussion are the products of deliberate production. Only a small number results from more expedient processes (*ad hoc* tools). Rather it is clear that the tools were produced according to well-established templates of manufacturing



Figure 12.10. Needle from split rib, A.385 (L. 10.6 cm).

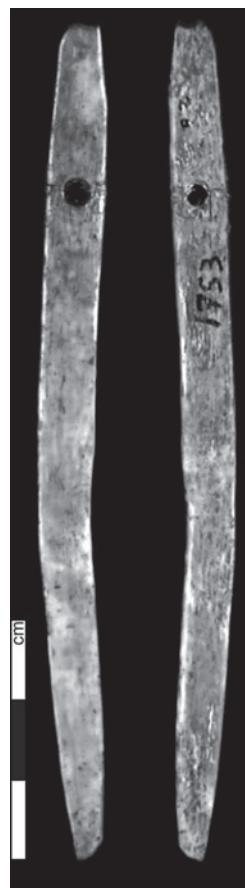


Figure 12.12. Needle (repaired) from split rib, A.1753 (L. 11.5 cm).

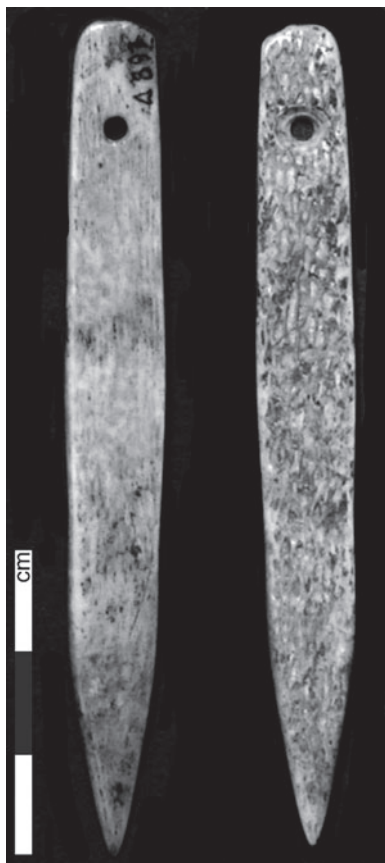


Figure 12.11. Needle from split rib, A.397 (L. 8.3 cm).



Figure 12.13. Edged tool from cattle-sized rib, A.1811 (L. 14.8 cm).



Figure 12.14. Antler basal part, with shaft hole and socket, Δ.35 (L. 11.3 cm).

practices. Some artefacts were repaired and reused (e.g., pointed implements and needles).

A number of artefacts were deposited in the cave as worn-out items, after long use-repair-wear/breakage. In contrast, the needles were capable of further use and/or modification when they were discarded.

The number of bone and antler artefacts from Alepotrypa Cave, when compared with the long-term use of the site, is low. The composition of the assemblage is also limited. For example, tools for the processing of hides/leather or wood, as well as fishing hooks (see Campana 1989, 101–103; Stratouli 1998, 146–158, 2008) are scarce or absent.

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Note

- 1 The author prefers the tripartite chronological system for the Neolithic advocated by Sampson (most recently, 2008)

and others, although the chronological system of Renfrew (1972) and Phelps (2004) in which a fourth period, the Final Neolithic, spans the end of the Neolithic, is used by the other contributors to this volume. Thus the Late Neolithic II period of Sampson and as used in this chapter corresponds to the Final Neolithic period as used elsewhere in this volume. See Chapters 2 and 3, this volume, for radiocarbon dating and periodization at Alepotrypa.

Bibliography

- Campana, D.V. (1989) *Natufian and Protoneolithic Bone Tools. The Manufacture and Use of Bone Implements in the Zagros and the Levant*. (British Archaeological Report S494). Oxford.
- Christidou, R. (1997) Dimitra. Bone working. In D. Grammenos (ed.) *Νεολιθική Μακεδονία*, 128–199. Ταμείο Αρχαιολογικών Πόρων, Athens.
- Christidou, R. (2005) Aspects of bone exploitation in the Neolithic sites of Eastern Macedonia, Greece. In H. Luik, A. M. Choyke, C. E. Batey and L. Lõugas (eds) *From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present. Proceedings of the 4th Meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th–31st August 2003*, 91–104. Tallinn.
- Gates St-Pierre, C. (2007) Bone awls of the St. Lawrence Iroquoians. A microwear analysis. In C. Gates St-Pierre and R. B. Walker (eds) *Bones as Tools, Current Methods and Interpretations in Worked Bone Studies*, 107–118. (British Archaeological Report S1622). Oxford.
- Gijn, A. van. (2005) A functional analysis of some late Mesolithic bone and antler implements. In H. Luik, A. M. Choyke, C. E. Batey and L. Lõugas (eds) *From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present. Proceedings of the 4th Meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th–31st August 2003*, 47–66. Tallinn.
- Katsipanou-Margeli, B. (2011) Οστέινα εργαλεία. In G. A. Papathanassopoulos, *Το Νεολιθικό Διρό. Σπήλαιο Αλεπότρυπα*, I, 127–146. Athens.
- Legrand, A. (2005) New evidence on the bone reduction techniques from Khirokitia – Cyprus (7th millennium cal BC). In H. Luik, A. M. Choyke, C. E. Batey and L. Lõugas (eds) *From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present. Proceedings of the 4th Meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th–31st August 2003*, 91–104. Tallinn.
- Legrand, A. and Sidéra, I. (2007) Methods, means, and results when studying European bone industries. In C. Gates St-Pierre and R. B. Walker (eds) *Bones as Tools, Current Methods and Interpretations in Worked Bone Studies*, 67–79. (British Archaeological Report S1622). Oxford.
- Lyneis, M. M. (1988) Antler and bone artifacts from Divostin. In A. McPherron and D. Srejović (eds) *Divostin and the Neolithic of Central Serbia*. Pittsburgh.
- Papathanassopoulos, G. A and Katsipanou-Margeli, B. (2011) Σύμβολα λατρείας – γοήτρου και εξουσίας. In G. A. Papathanassopoulos, *Το Νεολιθικό Διρό. Σπήλαιο Αλεπότρυπα*, I, 214–231. Athens.

- Phelps, W. (2004) *The Neolithic Pottery Sequence in Southern Greece*. (British Archaeological Report S 259). Oxford.
- Renfrew, C. (1972) *The Emergence of Civilization. The Cyclades and the Aegean in the Third Millenium B.C.* London.
- Sampson, A. (2008) *The Sarakenos Cave at Akraephnion, Boeotia, Greece, vol. 1: The Neolithic and the Bronze Age*. Athens.
- Sidéra, I. (2005) Technical data, typological data, a comparison. In H. Luik, A. M. Choyke, C. E. Batey and L. Lõugas (eds) *From Hooves to Horns, from Mollusc to Mammoth. Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present. Proceedings of the 4th Meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th–31st August 2003*, 81–90. Tallinn.
- Stratouli, G. (1993) Osteina ergaleia apo tin ergaleiothiki tou paragou tis Neoteris Neolithikis. Yliko apo to Spilaio Skoteini Tharrounion Euvoias. In A. Sampson, (ed.), *Skoteini Tharrounion*, 496–526. Athens.
- Stratouli, G. (1998) *Knochenartefakte aus dem Neolithikum und Chalkolithikum Nordgriechenlands*. (Beiträge zur Ur- und Frühgeschichtlichen Archäologie des Mittelmeer-Kulturraumes 32). Bonn.
- Stratouli, G. (2008) Neolithika agkistria apo to Dispilio Kastorias. *Anaskamma* 2, 13–24.

The people of Alepotrypa

Anastasia Papathanasiou

(after J. L. Angel's The people of Lerna)

Introduction

The human osteological remains from Alepotrypa Cave have been analyzed and studied extensively since 1990; they have been published in a number of papers and monographs since 1994 (Papathanasiou 1999, 2000, 2001, 2003, 2005, 2009, 2013). Therefore, since it would be redundant to re-present the same material in detail, only a summary of the aforementioned publications will be given here for the completeness of this volume, as human skeletal remains and mortuary activities/rituals are an integral part of the interpretation of the cave.

It should be noted here, as a personal observation, that when the anthropological analysis began in the 1990s, it was conducted under totally different research conditions than today. At that time many specialist analyses that are now performed commonly and whose results are presented in this volume did not exist. Furthermore, Chamber Z had not been excavated, as well as much of the surrounding area of the cave, and most of the excavation notebooks were not available. Therefore, the study focused strictly on osteological analysis more than on mortuary interpretation, let alone on correlations with other materials or archaeological context. As our archaeological knowledge about the cave has increased, certain issues have been revised or elaborated further in the light of new findings or analyses.

The human skeletal material

Human skeletal material remains the major source for drawing conclusions about past life activities, biology, demography, pathology, and adaptation stresses by simple macro- and micro-examination of the osteological material

(Buikstra and Ubelaker 1994; Larsen 2015). Furthermore, chemical analyses add data on the absolute dating of the individual and the context it belongs to, as well as on diet, economy, and migration. The latter set of information is revealed from the analysis of the bone element isotopes themselves (DeNiro and Epstein 1978, 1981; Schoeninger *et al.* 1983; Schoeninger 1989; Ambrose and Norr 1993; Norr 1995; Richards and Hedges 1999). Additionally, observation of the layout of the skeletal material at the time of its excavation adds information about the mortuary behaviour of the communities of the past, and consequently about the respective social and cultural structures that formed it. Taphonomy, orientation, position, articulation, location, completeness – to name but a few parameters – and above all context are crucial for the interpretation and reconstruction of burial ritual behaviour and its critical role in assessing social structure. Alepotrypa Cave has yielded the largest and best-preserved osteological assemblage in Neolithic Greece as of now. The published MNI was 161 in 2001, but this number has increased significantly since then. Here a short overview both of the osteological analyses and the mortuary behaviour will be presented.

In summary, the demographic analysis of the MNI of 161 individuals from Alepotrypa Cave showed approximately equal proportions of males (17) and females (15); of adults (81) and subadults (80), but very few infants. This is an expected profile for a preindustrial population, except for the low prevalence of infants which would be expected to be higher. However, most of these individuals are only partially represented, often by one skeletal element only. The mean stature is 169.7 cm for males and 153.8 cm for females. The average age at

death for adults is 28.8 years, similar to other prehistoric assemblages from Greece. Their ages range from neonate or fetal up to 50 years of age. Life expectancy at birth is 17.87 years, with the critical age being from birth to 10 years. The sample is characterised by a high prevalence of child mortality and by a high fertility rate, with the fertility index standing at 0.28, indicative of an increasing number of young individuals (Papathanasiou 1999, 2001, 2005).

It is interesting, for the purposes of this chapter, to highlight and comment on the most prevalent characteristics of this group as they are indicated by the paleopathological analysis. The assemblage in general is characterised by: a low prevalence of dental caries and periosteal reactions, suggesting relatively good sanitary conditions; a low prevalence of dental enamel hypoplasias, implying a low degree of stress during the developmental age of childhood; a high prevalence of antemortem tooth loss and calculus, possibly related to the food preparation techniques, and a high prevalence of osteoarthritis and enthesopathies, implying strenuous and elevated physical activity (Papathanasiou 1999, 2001, 2005).

The following conditions, however, require more attention in this paper. The most frequently observed pathological conditions at Alepotrypa are cribra orbitalia (Figure 13.1) and porotic hyperostosis with a prevalence of 60.0% and 50.0% respectively. Both lesions are observed on subadults as well as on adults; most cases are mild or healed, but a few severe cases have also been observed. Both pathological conditions are a result of increased production of red blood cells in response to different kinds of either genetic or acquired anaemia (Stuart-Macadam 1985, 1989; Stuart-Macadam and Kent 1992). The most probable cause for the lesions observed in Alepotrypa (given the severity, prevalence, and expression of the conditions) is nutritional anaemia such as iron deficiency anaemia or deficiency in vitamin B₁₂, due in both cases to low consumption of animal meat (Walker *et al.* 2009; Larsen 2015). It is probable, assuming that we have a representative sample of the past community,

that the Alepotrypa population was experiencing chronic nutritional deficiency, but it is not possible to isolate a specific element. Even other factors such as high pathogen or parasitic loads might have contributed to these lesions. A diet low in animal protein also was confirmed by the dietary reconstruction with stable carbon and nitrogen isotopes, see below.

Dental attrition is present at a 37% level, in a remarkable tooth-wear pattern, namely the development of deeply-cupped occlusal surfaces. Cupping is a sign of processing grains with grinding stones, a process during which fine particles of the grinding stones are introduced into the food (Smith 1984; Costa and Greaves 1981). This characteristic wear is observed in agricultural groups whose diet was based heavily on ground grains and possibly reflects the use of coarse grinding stones in food preparation (see Stroulia, this volume).

Cranial depressed fractures (Figure 13.2) are observed relatively frequently in the series representing 13.0% or 9 out of 69 individuals. All fractures are small, circular, sometimes multiple, and well healed at the time of death. They are found mainly in adult males and one female: they are suggestive of interpersonal aggression and conflict, but not lethal encounters (Papathanasiou 2012). The causes of the observed interpersonal violence in Alepotrypa Cave cannot be determined. High levels of cranial trauma have been reported world-wide amongst various populations in marginal circumstances involving environmental deterioration, population stress, widespread social tensions and competition for limited resources: all are factors linked with violence (Walker 1989; Bickle and Whittle 2013; Meyer *et al.* 2015).

An unusually high prevalence of metopism (Figure 13.3) was recorded at Alepotrypa. Metopism is a genetically

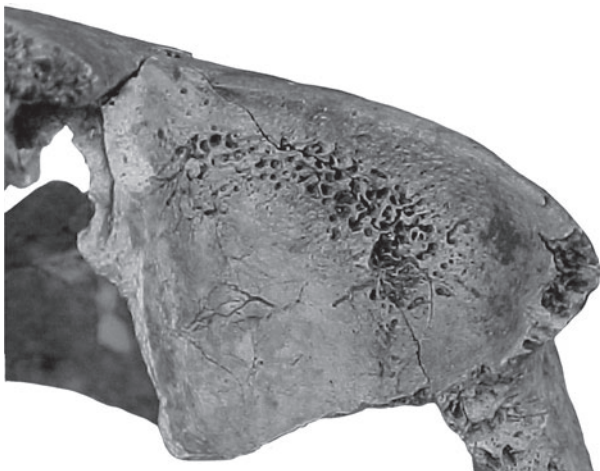


Figure 13.1. Cribra orbitalia.

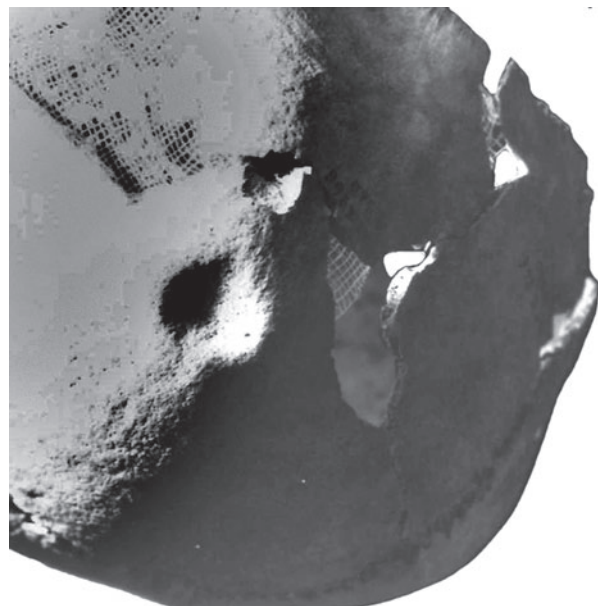


Figure 13.2. Healed depressed cranial fracture.



Figure 13.3. Metopism.

controlled, inherited trait by which the frontal suture persists beyond infancy (past the second or third year of life), when sutural obliteration is usually complete. It appears sporadically and infrequently in most populations, with the highest frequencies reaching up to 11–13% (Hauser and DeStefano 1989). In Alepotrypa a high prevalence of 15% was recorded in general, and specifically in Ossuary II the prevalence reaches 31%. As inferred statistically, metopism is significantly higher ($p < 0.12$) in Ossuary II with respect to the rest of the population, implying a genetic affinity for that segment of the group.

Dietary reconstruction

Stable isotope analysis of carbon and nitrogen in human bone collagen and carbonate apatite was conducted on 26 individuals from Alepotrypa Cave (Papathanasiou 2001,

2003). This isotopic analysis is based on the premise ‘you are what you eat’. Field and laboratory studies have shown that stable isotope ratios of both carbon and nitrogen in tissues, including bone, reflect similar ratios in the diet. Certain categories of foods vary predictably in their isotopic composition, and continual consumption of a food results in analogous isotope ratios in the bone (DeNiro and Epstein 1978; 1981; Schoeninger, DeNiro 1985; Ambrose 1990; van Klinken 1999; Schoeninger 1989; Ambrose and Norr 1993; Norr 1995; Richards and Hedges 1999). In the isotopic analysis of Alepotrypa Cave, both the very negative carbon values and the low nitrogen values strongly indicate the consumption of a diet focused largely on C_3 resources, which included mainly plants, probably domesticated, and to a lesser degree some animals (CPII 45). Marine foods appear to have been a minor part of the diet, despite the proximity of the site to the sea. Furthermore, the very small range of values implies a high degree of homogeneity in the diet of all individuals. The analysis suggests that the cave and the surrounding area were used by an agricultural group (or groups) with a land-based economy and a primarily agricultural subsistence strategy, with only occasional or periodic exploitation of the near-shore marine protein resources (Papathanasiou 2001, 2003).

Mortuary practices

In Alepotrypa an array of different burial practices is encountered. These include the following distinct types of disposal (Figure 13.4).

Primary burials

A) Single

Two single primary inhumations had been excavated by 1999; they have been published before (Papathanasiou

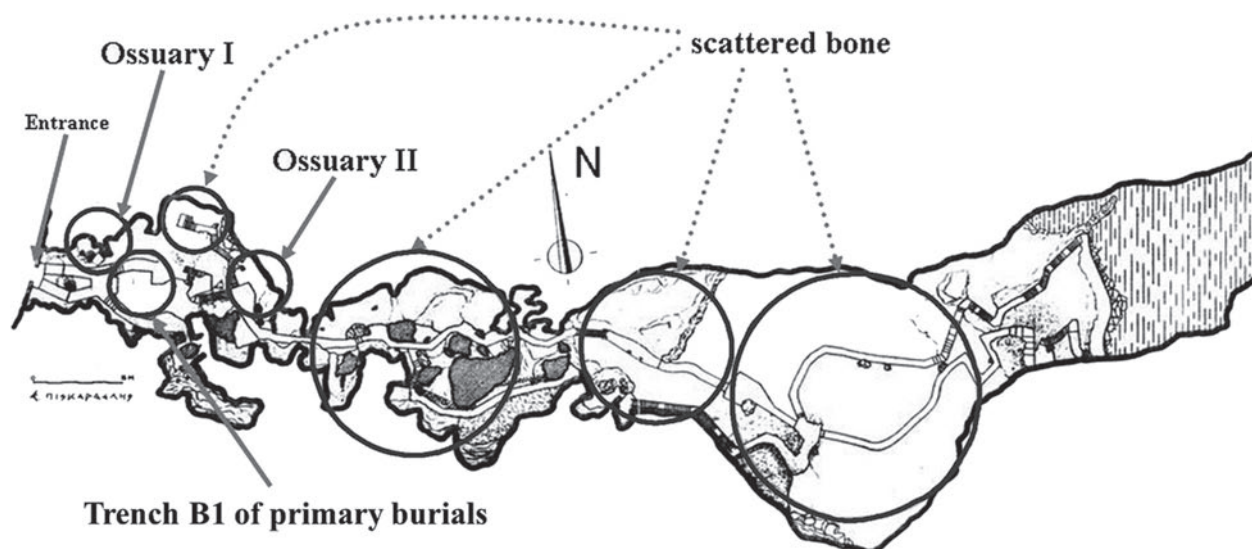


Figure 13.4. Distribution of burial types in Alepotrypa Cave.

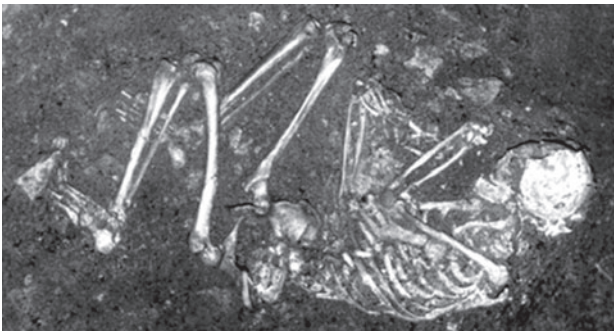


Figure 13.5. Single primary burial in Trench B1.



Figure 13.6. Multiple burial in Trench B1.

2001, 2009; Papathanassopoulos 2011; 1971). A 6-year-old child (A2056) in Ossuary I dated to 6,220–6,030 cal BC (Early Neolithic: OxA-29203, $7,246 \pm 36$ BP) and an adult female about 27 years old (A136), buried in a pit close to a stone-ringed hearth in trench B1 (Figure 13.5). The female burial was found in stratigraphic layer L4: it is dated to 4,050–3,940 cal BC (OxA-29207; $5,178 \pm 34$ BP (see Katsipanou, Karkanas this volume)). Both burials were flexed and lying on their right side with arms folded over their chests. In addition to the two published single primary burials, another four have been uncovered. First is a complete, *in situ*, articulated skeleton of an adolescent in the lowest layer of Trench B1, L15: dated to 6,010–5,880 cal BC (OxA-29208; $7,071 \pm 36$ BP), it was in a flexed position, lying on its left side with its arms folded to the chest. It was found next to a hearth or concentration of burnt logs, in the same context with some additional disarticulated skeletal elements of an older individual (see Katsipanou, Karkanas this volume). The second single burial was uncovered at the border of the North sector of Chamber B, near the wall of B8. It is an almost complete, *in situ*, articulated skeleton of an adult, found flexed and lying on its right side with arms folded over the chest. The third one lay very close to the second. It is a disturbed, partial, primary burial of an adult. All of the aforementioned primary burials were found in the anterior chambers of the cave (A and B), near the current entrance. The fourth primary burial was found in Chamber Z20. This is not actually a formal inhumation but a partial, articulated, skeleton lying extended on the surface of the cave in that niche. It is radiocarbon dated to 3,970–3,790 cal BC (OxA-29789; $5,092 \pm 32$ BP). None of the four burials have been removed yet.

B) Multiple

Much deeper than the female skeleton in Trench B1, in layer L14, a multiple primary burial was found: this yielded statistically identical radiocarbon dates of 5,480–5,320 cal BC and 5,470–5,330 cal BC (OxA-22013, 22012; see Table 2.1), placing them in the Middle Neolithic (A2201 and A2197 (see Katsipanou, Karkanas this volume)). It includes a MNI of 7 individuals, mostly young adults and adolescents (Figure 13.6). Two individuals were articulated

but partially represented, missing one or more limbs, while some other individuals are represented only by articulated limbs or just disarticulated elements. The articulated adult individual is a female of 30–40 years (A2197): she was in an extended position, face down, with arms at the sides, and the head rotated to the left. The subadult was *c.* 9 years old at the time of death (A2198). A probable (among several) interpretation of this burial is that the articulated skeletons may be the latest burials in the group; the less well-articulated remains in the grave probably represent earlier burials disturbed by periodic re-openings and reuse of the grave area, which in this case may have been marked. No grave goods accompanied the dead. In general, this multiple burial is characterised by commingled and careless deposition. Except for the intermixed and disarticulated nature of this deposit, no clear osteological evidence of perimortem trauma, violence, and/or mutilation has been observed on the skeletal remains, which possibly rules out interpretations of a violent massacre or of the defleshing and ritual processing of the dead (Meyer *et al.* 2015; Robb *et al.* 2015). Alternatively, some bones may have been deliberately removed from the burial, to be incorporated into a different context; or even bone from another context may have been added to this multiple burial, perhaps again, as some stage in an undefined ritual (Papathanasiou 2001, 2009).

Secondary burials

Secondary treatment of a body generally follows a liminal period of time during which the death of an individual becomes the object of a living society's collective representation (Hertz 1907/1960). According to van Gennep (1908/1960), rites of passage, which are ritualised ceremonial behaviours that serve to facilitate the passing of an individual from one state of being into another, require that the passing from one social position to another is accompanied with a territorial passage, or a change in location. Once the remains of the deceased receive proper secondary treatment (which includes a change in location), then the mourners and the deceased assume their new social positions. It is an at least two-stage practice: first the deceased is buried or is exposed. After a period during which the flesh had decomposed, selected remains

are collected and deposited at the second and final place of burial. Two unequivocal cases of secondary burial, namely two ossuaries of secondary deposit, have been excavated in Alepotrypa (see Katsarou, this volume). Both deposits were only partially excavated and their extent is not possible to be determined.

Ossuary I, in Chamber A (A3, 4) very close to the current entrance of the cave, is a thick mass of disarticulated human bones packed together with little intervening soil (Papathanasiou 2001, 2009). The skulls of two dogs and the mandible of a cow are buried, probably intentionally, in the same context, which also contains occasional pot sherds. Some human bones, including a skull, were surrounded by a ring of stones, reminiscent of a similar practice in the Franchthi Cave. At least 16 individuals are present – 3 neonates, 8 children, and 5 adults (3 females and 2 males). At the northern edge of the ossuary were three superimposed levels of child burials: the lowest is a tiny heap of bones from newborn, possibly premature, twins (A1921) on a prepared surface on the natural rock; the middle burial is a primary interment of a c. 6 year old (A2056; see above), carefully laid out on a prepared floor of stones with their flat sides up and covered with stones with their flat sides down facing the skeleton (this is radiocarbon dated to 6,220–6,030 cal BC (OxA-29203); and the uppermost comprises the disarticulated bones of a c. 4 year-old child (A1947), gathered together and propped up on stones (this is radiocarbon dated to 6,210–5,990 cal BC (OxA-29209; 7192 ± 37 BP)). As well as the two child burials, another skeletal element (A2073) has been radiocarbon dated to 6,100–5,930 cal BC (OxA-22037; 7162 ± 38 BP). All then belong to the Early Neolithic, and are contemporary with the adolescent primary burial in the lowest level L15 of Trench B1. Other areas of Ossuary I have yielded cultural material belonging to the Late/Final Neolithic. Even though only a part of Ossuary I has been fully excavated, there is evidence that this specific area was used exclusively and repeatedly for two to three thousand years as a dedicated burial site, mostly for secondary depositions. This place was apparently remembered and viewed as sacred.

In the fourth chamber (Chamber D/Δ), in the areas of the cave numbered 9 and 10, Ossuary II was uncovered, just a few centimetres below the surface (Lambert 1972; Papathanasiou *et al.* 2000; Papathanasiou 2001, 2009; see Figure 13.7).

Ossuary II consists of two main layers. The upper layer is brown soil and 25 cm thick: it contained no artefacts or bones. The second layer was dark brown soil and 20 cm thick: it contained stones, pottery sherds and animal bones. In the lower part of this second layer, traces of small fires and the bases of large pots, one on top of the other, were found, along with human skulls and other non-articulated human postcranial bones, all set on a previously prepared floor of small stones of a very dark colour. Usually missing their mandibles, the



Figure 13.7. Ossuary II.

skulls were propped up on their bases on the prepared floor, and were sometimes surrounded by a ring of stones. Broken vessels and animal bones may indicate offerings of food or graveside feasting. Other possible grave goods include a greenstone axe, an obsidian blade, and fragments of copper. Rodent tooth marks on a few bones suggest that some degree of exposure of the dead may have taken place before their reburial in the ossuary.

Nineteen individuals are represented in this ossuary by 14 skulls and other disarticulated cranial and postcranial bones. Nine adults (including 3 probable females and 5 probable males) and ten children and adolescents were found, but no neonates. The large number of cranial bones (41% of the sample) indicates not only selective reburial, but also ritual manipulation of the skulls. Ossuary II is also partially excavated. The radiocarbon dates of the different skeletal elements are: (A489, A480, A452, A372, and A311) date to 4,150–3,940 cal BC, 4,230–3,810 cal BC, 4,240–3,990 cal BC, 4,240–3,990 cal BC and 3,970–3,790 cal BC (OxA-22010, 22009, 22008, 22566, 29789; Table 2.1; respectively; Final Neolithic).

A potential case of cremation has been reported in past publications (Papathanasiou 2001; 2009) which now should be revised: placed in a small, tight and inaccessible niche at the end of Chamber Z and at the entrance of Chamber of Lakes, (Niche 31). The skeletal remains of two children (1½ and 3½ years old), accompanied with shell beads and covered by huge amounts of broken pottery (much of it matt-painted ware) were found in an ashy deposit (see Psimogiannou, this volume). While clearly associated with the ash, the bones of the two children are not burnt; nor are any of the shell beads (no black spots of discoloration nor warping can be observed). In fact, the skeletal remains reflect another case of a secondary deposition in the cave, as each child is represented by a small number of disarticulated elements. The dark ash, beads, and broken fine wares may point to ceremonies related to the loss of children. A radiocarbon date of one of the children's bones places its death at 4,230–3,960 cal BC (OxA-29206; 5213 ± 32 BP; Final Neolithic).

Bone scatter

Scattered bone is defined as isolated skeletal fragments mixed with other cultural debris. While there is little doubt that some of the bone scatter is the result of formal burials having been inadvertently disturbed by later inhabitants, it is also possible that bone scatter played a role in mortuary ritual (Cullen and Papathanasiou 2009, in preparation). Scattered bone is observed throughout the entire length of the cave and comprises a major part of the osteological assemblage of the cave, requiring investigation on the processes of its formation. In fact of the 4,100 or so recorded skeletal elements, over 1,800 comprise the category of 'bone scatter' (see below, quantitative analysis).

As a case of such a deposit, the osteological material collected from throughout Chamber Z should be considered. Chamber Z is a discrete area of the interior of the cave where distinct rituals had taken place repeatedly, involving the fragmentation and deposition of massive quantities of ceramics of certain types and burned animal dung (see Psimogiannou, this volume). A number of human remains is also involved in this context in the form of sporadic, disarticulated, and fragmented elements. The possibility that this is an intentional secondary deposition cannot be excluded but, technically, the general picture is one of scattered bones.

Differentiation of general characteristics of the burials

In general, regarding offerings, it is difficult to distinguish intentional grave goods from settlement debris included in the filling of the grave sites, but potsherds are frequent, and stones and pebbles are used in various ways. Most burials seem not to be accompanied by any offerings, excepting shell beads and animal bones. In terms of position and deposition, features that apply only to primary burials, there are cases of flexed bodies lying on their side, usually on the right, with arms folded on the chest and one case of an extended skeleton, (or possibly two, if we consider the individual on the surface of Z20 as a burial). No body preparation, vehicle of disposal or specific orientation of the body has been identified.

In terms of individuality, the numbers of persons involved in a burial, there are single or multiple individuals in the category of primary inhumations, an intermingling of multiple individuals in the secondary burials, and very partial representation in the case of bone scatter (if we accept that the last was the result of intentional action). In almost all cases, however, the prevailing picture is one of incomplete representations of the individual. Even in the contexts of the primary burials there are excessive bones or missing bones. In terms of articulation, the primary inhumations are articulated or semi-articulated, while the secondary inhumations are disarticulated and mixed. Disarticulation, fragmentation, commingling, and moving of the skeletal

elements are the most prevalent characteristics of the entire sample.

In terms of the location of the disposal areas, burials of some form exist everywhere in Alepotrypa Cave, in all the deposits through time and space: from the earliest at c. 6,000 cal BC (the twin neonates of Ossuary I and the complete adolescent of the lowest levels of Trench B1) to the last, probably unburied, remains on the surface of the cave, including the bone scatter. Therefore, all the cases are marked by the close physical proximity between the spheres of the living and those of the dead, if this is the correct way of viewing it. The burial sites have been dug into and built up with deposits replete with the debris of everyday activity such as worn sherds and tools. Alternatively, domestic material was brought into the burial sites to accompany the dead or as a part of certain associated rituals and depositions. However, there is evidence that certain burial sites were special locations; they were dedicated and delimited areas, reserved exclusively for the disposal of the dead. These were used exclusively for successive episodes of the same practice/ritual during a period of at least two thousand years. Another differentiation that can be noted for the location of the burials is that all the primary, intentional burials (not the unburied dead on the cave floor), either single or multiple, exist only in the two front chambers of the cave (Chambers A and B), closer to the entrance. The secondary depositions and the highly fragmentary bone scatter, by contrast, are associated with all the chambers of the cave including Chambers A and B.

Quantitative analysis of the osteological remains

The quantitative analysis of the excavated human skeletal remains can further illuminate the mortuary practices observed throughout Alepotrypa. The spatial distribution and the relative representation (the quantity, proportion, and bone elements present in comparison with a complete skeleton) of the human remains were assessed, in an effort to identify any meaningful patterning. All bone elements were mapped using GIS. The premise in this enquiry was that, after any taphonomic processes were excluded, which could have affected distribution, the emerging spatial patterning and the relative representation of the skeletal material throughout the cave would not necessarily be random. As such, the distribution may reflect past cultural behaviours and decisions.

The relative representation in correlation with the spatial distribution of all bone elements from all burial types for the entire assemblage was considered. The question under consideration was: are certain burial types, which are characterised by a discrete/distinctive representation of body parts, the result of the burial process followed? Such a matter would differentiate and characterise the use of the burial sites. The distribution itself and the spatial patterning of the skeletal sample could provide insight into the funerary behavioural processes. The total number reported for each

element contains both complete bones and bone fragments. Thus, a single bone, if in fragments, may be represented multiple times in the total count. The skeletal elements were grouped in five categories: cranial bones, hands and feet (including metacarpals, metatarsals, and phalanges), long bones, and torso (including shoulder and pelvic bones, vertebrae, and ribs). Relative representations were compared against the representation of the 206 bones of the complete adult human skeleton (Papathanasiou and Deskaj 2013).

The anatomical grouping of the bone scatter implies that cranial and long bone densities are higher in the

front and central portions of the cave, but in general the bone scatter is clustered in the same, specific areas of the cave along with the rest of the cultural material (Figures 13.8–10). In body part representation, cranial and body bones vary significantly across the different cave areas. No two areas are alike, as pair-wise statistical tests indicate statistically significant differences. Last, a pattern is observable as cranial and long bones consistently dominate over smaller elements both in prevalence in absolute numbers and also in their presence in all parts of the cave (Figures 13.8–10).



Figure 13.8. Distribution of the skeletal elements of limbs.

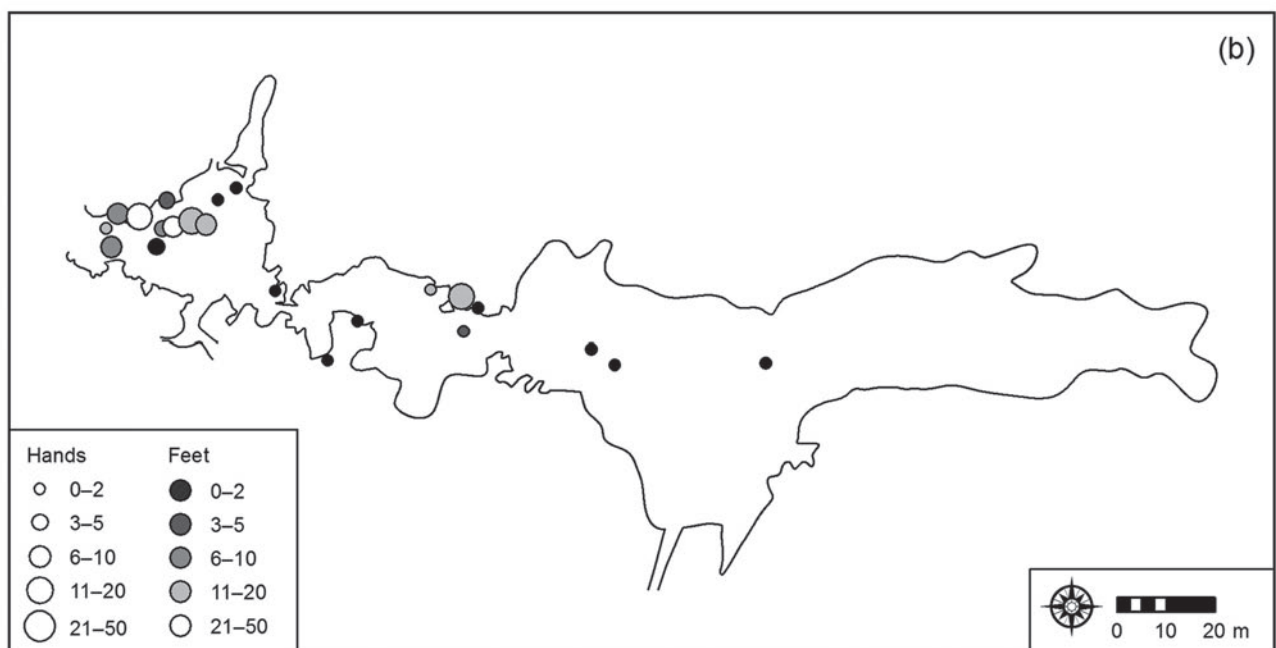


Figure 13.9. Distribution of the skeletal elements of hands and feet.

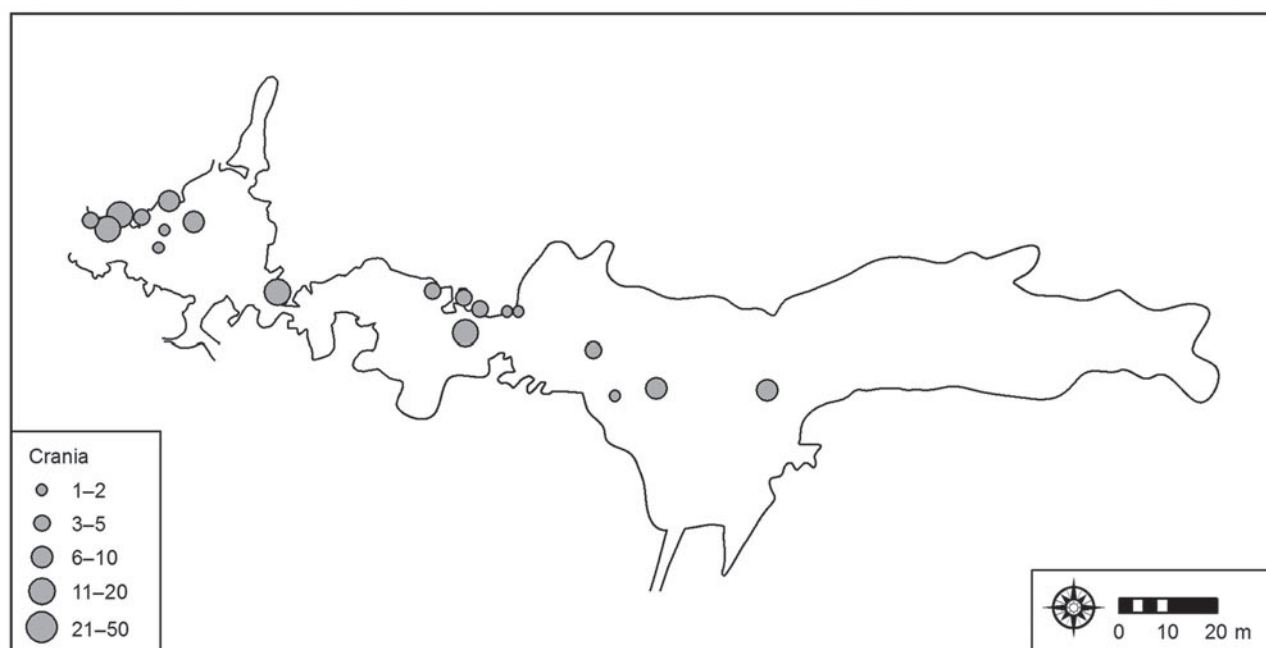


Figure 13.10. Distribution of cranial elements.

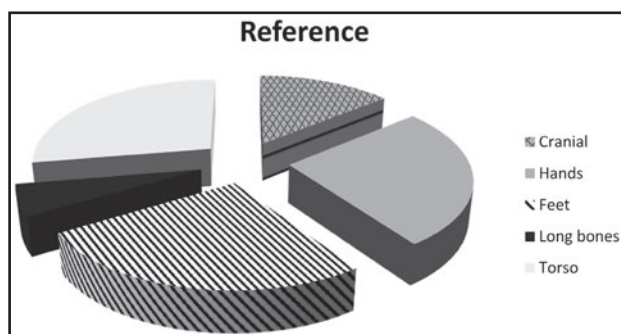


Figure 13.11. Relative prevalence of the elements of a complete human skeleton.

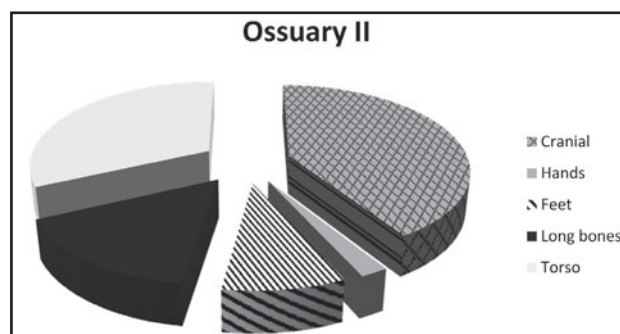


Figure 13.12. Relative prevalence of skeletal elements in Ossuary II.

The presence of long bones varies from 29% to 49%, which is consistently more than their frequency in the human skeleton (Figure 13.11), while cranial bones exhibit a wider range (4% to 41%), possibly implying selective treatment in certain areas. In Ossuary II (Figure 13.12), there is a significantly higher presence of cranial and long bones, as is to be expected for a secondary selective reburial site. In fact the highest prevalence of cranial bones (41%) is observed here, indicating special attention to this element. Ritual manipulation of the skulls is also observed: missing their mandibles, they are often propped up on their bases, surrounded by stones.

Although Ossuary II exhibits a clear picture of a significantly higher prevalence of cranial and long bones, Ossuary I does not conform with the same picture (Figure 13.13). Statistically different from Ossuary II, it resembles more the North Sector bone scatter (Figure 13.14), while still remaining statistically distinct. This result

statistically verifies the archaeological evidence, namely that Ossuary I fulfilled a greater range of functions, including both primary and secondary burials. To this extent, osteologically, it resembles other areas of the cave which are characterised by primary burials as well, and differs from areas with exclusively secondary burials. On the contrary, Chamber Z is dominated by long bone fragments, followed by body elements (Figure 13.15).

Broadly speaking, the entire assemblage of Alepotrypa Cave provides a picture of secondary deposition (Figures 13.8–10 and 16), as it is characterised first by higher frequencies of cranial and long bones, the selected elements for reburial, and then by very low frequencies of hand, foot, vertebrae, ribs, the small bones – the leftovers, though numerically the largest category of bones in the human skeleton. The initial hypothesis was that some areas of the cave were used for primary burials, with others for secondary burials, whilst the bone scatter

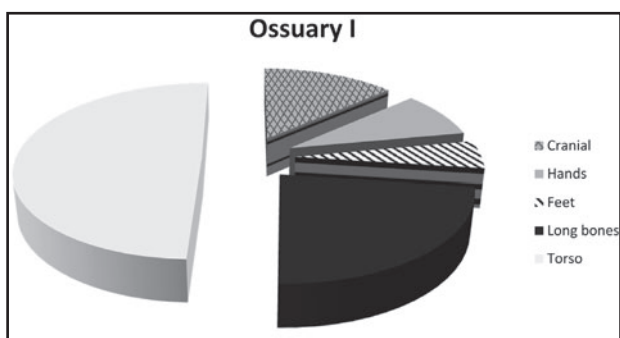


Figure 13.13. Relative prevalence of skeletal elements in Ossuary I.

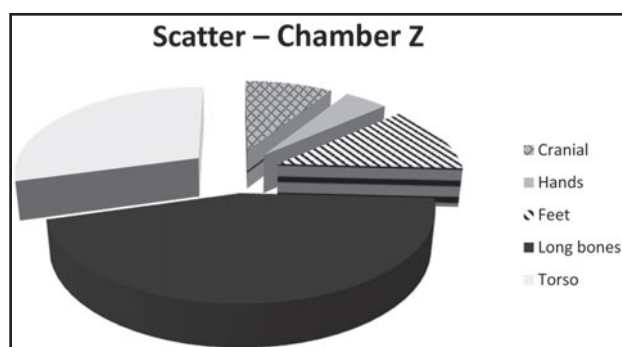


Figure 13.15. Relative prevalence of skeletal elements in Chamber Z.

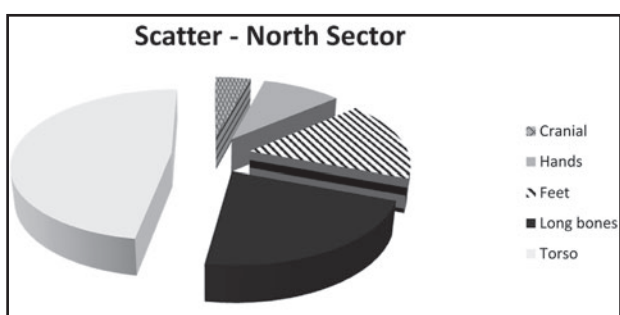


Figure 13.14. Relative prevalence of skeletal elements in the North Sector of Chamber B.

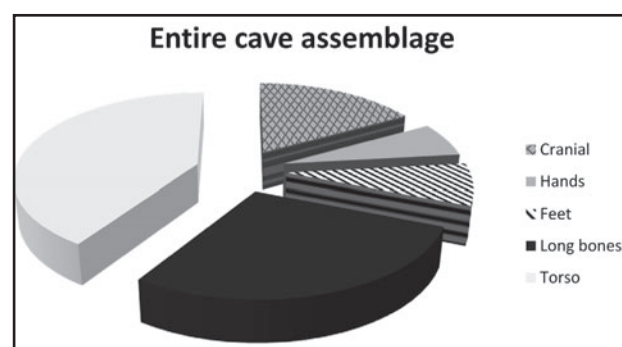


Figure 13.16. Relative prevalence of skeletal elements for the entire osteological assemblage of Alepotrypa Cave.

would mark the leftovers produced in the transference of the primary burials. However, this is not supported by the existing evidence. Even the bone scatter category is dominated by long bones, instead of the expected small ones. However, body-part representation suggests that such a procedure may have occurred in a *different place*, perhaps outside the cave, in the surrounding area. Somewhere here might be the original place of primary burial, and there should be leftovers from those primary burials in that location. This needs to be investigated. If correct, instead of a pattern existing within various parts of the cave, the differentiation would be more likely to be expressed between the interior of the cave and its external surroundings.

A similar picture emerges if we compare Alepotrypa to Franchthi (Cullen 1999; Cullen and Papathanasiou 2009, in preparation; see Figure 13.17). In sharp contrast to Alepotrypa, the Franchthi Paralia, the open-air site in front of Franchthi cave, is dominated by hand and foot bones. It is possible that these bones were left behind when primary burials were collected for secondary deposit. The assemblage from both of the caves' interiors exhibits an unexpectedly high prevalence of long bones, especially legs. The percentage of cranial bones in the Alepotrypa scatter is not as high as at Franchthi (only 9% of the total scatter assemblage for Alepotrypa, versus the 35% at Franchthi), but the two ossuaries at Alepotrypa indicate that skulls were the selective focus of the mortuary activity at these locations.

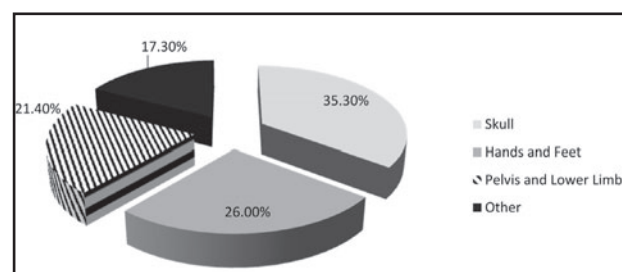


Figure 13.17. Relative prevalence of skeletal elements for the entire osteological assemblage of Franchthi Cave.

The concentration of cranial bone at Alepotrypa ossuaries is much higher than at Franchthi, thus implying similar, but perhaps even more intensive, processes.

Mortuary inferences

The disposal of the dead is a social ritual action that contains layers of symbolic meaning. In other words, attention and care goes into the funerary rites, such as inhumation, exhumation, and/or secondary treatment of the dead. These events are not random practices but they express and help re-negotiate and/or maintain the social relations of the living. In the archaeological record, these events may appear as processual regularities that can be observed, tested, and interpreted. Therefore, the mortuary expression

and the associated rituals excavated at Alepotrypa are considered social projects, which can help to assess the symbolic sphere and social relations of the community/ies who used the cave and the ways in which they memorialised their dead. The main characteristics of the burials are: a) diversity in form, as mentioned above (formal ossuaries and other ritual secondary depositions, pit graves, single and multiple inhumations, and massive quantities of scattered bone); b) absence of evidence of inequality in mortuary patterning, as grave goods are rare; c) continuity of practice, as the dedication of certain locations for certain ceremonies suggest; and d) highly transformative practices including fragmentation, disarticulation and commingling. Intact human skeletons are not a common archaeological feature at Alepotrypa Cave; the mortuary signature is complex and variable. 'There is an obvious contrast to be drawn with Neolithic barrows or tumuli in other parts of the world, where ostentatious display often highlights the lines of power connecting ancestors with their descendants' (Cullen and Papathanasiou 2009). Therefore, in Alepotrypa there is no architectural monumentality or richness of offerings, but impressively elaborate rituals and the repetition of specific activities for at least two millennia: these features all point to a lasting place of social significance, possibly related to formalised mortuary performance through time. The observed continuity of several dimensions of ritual could indicate that the entire cave may have been the centre of a ritual landscape, a monument for a specific or a broader area.

In particular, two of the mortuary practices that characterise Alepotrypa are preferential treatment of human skulls and secondary depositions. Veneration and ritual treatment of human skulls, sometimes in evocative contexts, is long known as a characteristic of Near Eastern Neolithic and Mesolithic prehistory, as well as of prehistoric Greece (Mellaart 1961, 1967, 1970a, 1970b; Talalay 2004; Ozdogan 1999; Chouher 2010; Schulting 2015; and Katsarou, this volume). The human skull makes a powerful symbol to signal ethnicity, ancestry, personal power, and political authority and as such is invested with meaning. Ethnographic and historic evidence suggest that human skulls are interpreted as dynamic ritual objects which take roles as expressions of the power in the forming of political or social groups. Traditionally, this has been interpreted as a way of expressing territoriality among early societies or enhancing the unity of the clan, but with some 'blurring of the lines between revered ancestor and enemy' (Schulting 2015). An equivalent practice of preferential treatment of skulls along with long bones, as the most representative elements for the memory of the dead ancestors, is observed in Alepotrypa Cave. As mentioned above, complete human skulls or cranial bones are the dominant elements both in the ossuaries and in the general scatter bone assemblage. Questions however remain on the criteria in the choosing and on the processes of selective reburial of the human skulls, and

to determine if the practice was a local one or the norm over a broader area.

Furthermore, secondary burial is a most intriguing practice in the marking of the memory of the dead. Secondary burials first integrate the ancestors into the community, stressing a collective identity. They also renegotiate aspects of social life such as authority, ownership, or affiliation, which are transferred and re-inscribed in the course of the mortuary ritual, in order to validate and regulate rights and holdings and at the same time, through the veneration of the dead, to maintain social coherence and continuity. Additionally, the disarticulated and commingled material – either within the cave or with connections to other places – is revisited, as it has been transfigured to meet the community's values on collective memory, identity and social coherence. Dismembered bodies and objects constitute the linking mnemonic medium, integrating the dead with the living and the past with the future.

Within the context of subsistence-settlement systems, demographic and social processes, and the invocation of the ancestors as a key element in social strategies, models have been developed, which state that groups are more likely to maintain formal disposal areas for the dead rather than dispersed grave-sites, when control of restricted resources is crucial (Goldstein 1976; Charles and Buikstra 1983; Chapman 1990, 1995; Cullen 1985).

Additionally, elevated interpersonal violence has been associated with societies committed to a mixed farming-herding way of life, which reduces their mobility and choices. When the landscape becomes increasingly populated and subjected to claims of ownership and use rights, these issues become more of a factor in the instigation of violence (Schulting and Wysoski 2005).

Summarising the osteological data from Alepotrypa, evidence exists for all the aforementioned parameters: a stressed and increasing population, a land-based sedentary, agricultural, subsistence economy, reduced mobility, elevated interpersonal violence, and possible familial relationships between some of the individuals. Mortuary data additionally indicate that disarticulation, fragmentation, commingling, and moving of the skeletal elements are the most prevalent characteristics of the entire sample through time.

Therefore, the existence of formal secondary burial areas in the cave or the notion of the entire cave as a mortuary monument of secondary disposals could be linked with the observations of increasing and competing community/ies, a focus on agricultural subsistence, and reduced mobility. If the people using Alepotrypa Cave had to defend their economic interests, secondary burials can be viewed as attempts to create ancestral authority and inheritance and to establish control of critical resources (such as arable land, water, pasture, or, indeed, even control of the cave itself), and at the same time to preserve the community/ties (Cullen 1995). The commingling

of the remains of the ancestors marks a social device to retain group coherence, and to emphasise continuity either locally or over a broader area. At the same time, creating specific places for the successive placement of the dead, probably through familial relationships, may have served to emphasise one or more subgroups' claim or attachment to the site and the surrounding resources, while simultaneously creating a collective memory of the past.

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Bibliography

- Ambrose, S. H. (1990) Preparation and characterization of bone and tooth collagen for isotopic analysis. *Journal of Archaeological Science* 17, 431–451.
- Ambrose, S. H. and Norr, L. (1993) Experimental evidence for the relationship of the carbon isotope ratios of whole diet and dietary protein to those of bone collagen and carbonate. In J. B. Lambert, and G. Grupe (eds) *Prehistoric Human Bone: Archaeology at the Molecular Level*, 1–38. New York.
- Bickle, P. and Whittle, A. (eds) (2013) *The First Farmers of Central Europe: Diversity in LBK Lifeways*. (Cardiff Studies in Archaeology). Oxford.
- Buikstra, J. E. and Ubelaker, D. H. (eds) (1994) *Standards for Data Collection from Human Skeletal Remains*. (Arkansas Archaeological Survey Research Series 44). Fayetteville.
- Chapman, R. (1990) *Emerging Complexity: the Later Prehistory of South-east Spain, Iberia and the West Mediterranean*. Cambridge.
- Chapman, R. (1995) Ten years after – megaliths, mortuary practices, and the territorial model. In L. A. Beck (ed.) *Regional Approaches to Mortuary Analysis*, 29–51. New York.
- Charles, D. K. and Buikstra, J. E. (1983) Archaic mortuary sites in the central Mississippi drainage: distribution, structure, and behavioral implications. In J. L. Phillips and J. A. Brown (eds) *Archaic Hunters and Gatherers in the American Midwest*, 117–145. New York.
- Costa, R. L. and Greaves, W. S. (1981) Experimentally produced tooth wear facets and the direction of jaw motion. *Journal of Paleontology* 55, 635–638.
- Croucher, K. (2010) Bodies in pieces in the Neolithic Near East. In K. Rebay-Salisbury, M. L. Stig Sørensen, and J. Hughes (eds) *Body Parts and Bodies Whole: Changing Relations and Meanings*, 6–19. Oxford.
- Cullen, T. (1985) Social implications of ceramic style in the Neolithic Peloponnese. In W. D. Kingery (ed.) *Ancient Technology to Modern Science, Ceramics and Civilization*, 77–100. Columbus.
- Cullen, T. (1995) Mesolithic mortuary ritual at Franchthi Cave, Greece. *Antiquity* 69, 270–289.
- Cullen, T. (1999) Scattered human bones at Franchthi cave: remnants of ritual or refuse? In P. P. Betancourt, V. Karageorghis, R. Laffineur and W.-D. Niemeier (eds) *Meletemata, Studies in Aegean Archaeology Presented to Malcolm H. Wiener as He Enters his 65th year*, 165–170. (Aegeum 20). Liège and Austin.
- Cullen, T. and Papathanasiou, A. (2009) Funerary markings of memory: mortuary ritual at Neolithic Franchthi Cave and Alepotrypa Cave. *CSPS International Conference Honouring the Dead in the Peloponnese. Sparta April 23–26, 2009*. unpublished spoken paper.
- DeNiro, M. J. and Epstein, S. (1978) Influence of diet on the distribution of carbon isotopes in animals. *Geochimica and Cosmochimica Acta* 42, 495–506.
- DeNiro, M. J. and Epstein, S. (1981) Influence of diet on the distribution of nitrogen isotopes in animals. *Geochimica and Cosmochimica Acta* 45, 341–351.
- Goldstein, L. G. (1976) *Spatial Structure and Social Organization: Regional Manifestations of Mississippian Society*. Unpublished PhD Dissertation. Northwestern University, Evanston, Illinois.
- Hauser, G. and De Stefano, G. F. (1989) *Epigenetic Variants of the Human Skull*. Stuttgart.
- Hertz, R. (1960) A contribution to the study of the collective representation of death. In R. Hertz (ed.) *Death and the Right Hand (1907)*, translated by R. and C. Needham, 27–86 and 117–154. London.
- Lambert, N. (1972) Grotte d'Alepotrypa. *Bulletin de correspondance hellénique* 96, 845–871.
- Larsen, C. S. (2015) *Bioarchaeology. Interpreting Behaviour from the Human Skeleton*. Second edition. Cambridge.
- Mellaart, J. (1961) Excavations at Hacilar, fourth preliminary report, 1960. *Anatolian Studies* 11, 39–75.
- Mellaart, J. (1967) *Çatal Höyük: A Neolithic Town in Anatolia*. London.
- Mellaart, J. (1970a) *Excavations at Hacilar 1*. Edinburgh.
- Mellaart, J. (1970b) *Excavations at Hacilar 2*. Edinburgh.
- Meyer, C., Lohr, C., Gronenborn, D. and Alt, K. W. (2015) The massacre mass grave of Schöneck-Kilianstädten reveals new insights into collective violence in Early Neolithic Central Europe. *Proceedings of the National Academy of Science USA* 112, 11217–11222.
- Norr, L. (1995) Interpreting dietary maize from stable isotopes in the American tropics: the state of the art. In P. W. Stahl (ed.) *Archaeology in the Lowland American Tropics: Current Analytical Methods and Applications*, 198–223. Cambridge.
- Özdoğan, A. (1999) Çayönü. In M. Özdoğan and N. Başgelen (eds) *Neolithic in Turkey: The Cradle of Civilization. New Discoveries*, 35–63. Istanbul.
- Papathanasiou, A. (1999) *A Bioarchaeological Analysis of Health, Subsistence and Funerary Behavior in the Eastern*

- Mediterranean Basin: A Case Study from Alepotrypa Cave, Southern Greece*. Unpublished PhD thesis, University of Iowa.
- Papathanasiou, A. (2001) *A Bioarchaeological Analysis of Neolithic Alepotrypa Cave, Greece*. (British Archaeological Report S961). Oxford.
- Papathanasiou, A. (2003) Stable isotope analysis in Neolithic Greece and possible implications on human health. *International Journal of Osteoarchaeology* 13, 314–324.
- Papathanasiou, A. (2005) Health status of the Neolithic population of Alepotrypa Cave, Greece. *American Journal of Physical Anthropology* 126, 377–390.
- Papathanasiou, A. (2009) Mortuary behaviour in Alepotrypa Cave: assessments from the study of the human osteological material. In W. G. Cavanagh, C. Gallou and M. Georgiadis (eds) *Sparta and Laconia: From Prehistory to Pre-modern. Proceedings of the Conference Held in Sparta, Organised by the British School at Athens, the University of Nottingham, the 5th Ephoreia of Prehistoric and Classical Antiquities and the 5th Ephoreia of Byzantine Antiquities, 17–20 March 2005*, 21–28. (British School at Athens Studies 16). London.
- Papathanasiou, A. (2012) Evidence of trauma in Neolithic Greece. In R. J. Schulting and L. Fibiger (eds) *Sticks, Stones and Broken Bones. Proceedings of the Neolithic Violence in a European Perspective Conference*, 249–263. Oxford.
- Papathanasiou, A. and Deskaj, S. (2013) *Mapping the spatial distribution of the mortuary remains at Neolithic Alepotrypa Cave, Greece*. Poster presented at the 82nd Annual Meeting of the American Association of Physical Anthropologists, April 2013, Knoxville.
- Papathanasiou, A., Karkanias, P., Katsarou, S., Valvis, G., Psimogiannou, K. and Tsartsidou, G. (2013) *Alepotrypa Cave, Diros, 6000–3500 BC: new evidence sheds new light on the excavated material*. Unpublished paper presented at the International Conference *Communities in Transition: The Circum-Aegean Later Neolithic Stages (c. 5000/4800–3200/3000 B.C.)*, Conference held at the Athens Acropolis Museum and the Danish Institute in Athens, 7–9 June 2013, Athens.
- Papathanasiou, A., Larsen, C. S. and Norr, L. (2000) Bioarchaeological inferences from a Neolithic ossuary from Alepotrypa Cave, Diros, Greece. *International Journal of Osteoarchaeology* 10, 210–228.
- Papathanassopoulos, G. A. (1971) Σπήλαια Διρού, 1971. *Archaiologika Analekta ex Athenon/Athens Annals of Archaeology* 4, 12–26, 149–154, 289–304.
- Papathanassopoulos, G. A. (2011) *Το Νεολιθικό Διρό*. Athens.
- Richards, M. P. and Hedges, R. E. M. (1999) Stable isotope evidence for similarities in the types of marine foods used by Late Mesolithic humans at sites along the Atlantic coast of Europe. *Journal of Archaeological Science* 26, 717–722.
- Robb, J., Elster E. S., Isetti, E., Knüsel, C. J., Tafuri, M. A. and Traverso, A. (2015) Cleaning the dead: Neolithic ritual processing of human bone at Scaloria Cave, Italy. *Antiquity* 89, 39–54.
- Schoeninger, M. J. (1989) Reconstructing prehistoric human diet. In T. Douglas Price (ed.) *Chemistry of Prehistoric Human Bone*, 38–67. Cambridge.
- Schoeninger, M. J. and DeNiro, M. J. (1984) Nitrogen and carbon isotopic composition of bone collagen from marine and terrestrial animals. *Geochimica et Cosmochimica Acta* 48, 625–639.
- Schoeninger, M. J., DeNiro, M. J. and Tauber, H. (1983) Stable isotope nitrogen ratios of bone collagen reflect marine and terrestrial components of prehistoric human diet. *Science* 220, 1381–1383.
- Schulting, R. J. (2015) Mesolithic ‘skull cults’? In K. von Hackwitz and R. Peyroteo Stjerna (eds), *Ancient Death Ways*, 19–46. Uppsala.
- Schulting, R. J. and Wysocki, M. 2005. ‘In this chambered tumulus were found cleft skulls ...’: an assessment of the evidence for cranial trauma in the British Neolithic. *Proceedings of the Prehistoric Society* 71, 107–138.
- Smith, B. H. (1984) Patterns of molar wear in hunter-gatherers and agriculturalists. *American Journal of Physical Anthropology* 63, 39–56.
- Stuart-Macadam, P. (1985) Porotic hyperostosis: representative of a childhood condition. *American Journal of Physical Anthropology* 66, 391–398.
- Stuart-Macadam, P. (1989) Nutritional deficiency diseases: a survey of scurvy, rickets, and iron-deficiency anaemia. In M. Y. Iscan, and K. A. R. Kennedy (eds) *Reconstruction of Life from the Skeleton*, 201–222. New York.
- Stuart-Macadam, P. and Kent S. (eds) (1992) *Diet, Demography and Disease: Changing Perspectives on Anemia*. New York.
- Talalay, L. E. (2004) Heady business: skulls, heads, and decapitation in Neolithic Anatolia and Greece. *Journal of Mediterranean Archaeology* 17, 139–163.
- Van Gennep, A. (1960) *Les rites de passage* (1909). English translation, *The Rites of Passage*. Chicago.
- Van Klinken, G. J. (1999) Bone collagen quality indicators for palaeodietary and radiocarbon measurements. *Journal of Archaeological Science* 26, 687–695.
- Walker, P. L. (1989) Cranial injuries as evidence of violence in prehistoric southern California. *American Journal of Physical Anthropology* 80, 313–323.
- Walker, P. L., Bathurst, R. R., Richman, R., Gjerdrum, T., and Andrushko, V. A. (2009) The causes of porotic hyperostosis and cribra orbitalia: a reappraisal of the iron-deficiency-anemia hypothesis. *American Journal of Physical Anthropology* 139, 109–125.

The macrofaunal assemblage of Alepotrypa Cave

Angelos Hadjikoumis

Introduction

This chapter concerns the study of the macrofaunal remains recovered from the archaeological excavations at Alepotrypa Cave (Lakonia, Peloponnese). Details on the archaeological context and chronology, as well as studies of other categories of materials, are presented and discussed in other chapters in this volume. To get a fuller picture of the different types of interaction that developed between humans and animals at the site, this chapter should be read with the chapters on microfaunal (Papayiannis, this volume) and fish remains (Theodoropoulou, this volume). This study involves substantial macrofaunal samples excavated in Chambers A, B, D and Z of the cave. Most of the material in these samples is dated to one of three Neolithic phases – Early Neolithic (c. 6000 cal BC), Late Neolithic (c. 5,500–4,500 cal BC), Final Neolithic (c. 4,500–3,200 cal BC), or a combination of those. The human–animal interactions explored in this study mainly relate to economic, environmental and cultural themes, each addressing a multitude of specific questions.

The presence of samples of Early, as well as Late/Final Neolithic, date provides an evolutionary perspective to the questions addressed by this study. The economic importance of the husbandry of each domestic species, as well as the significance of the hunting of wild animals, is discussed on the basis of reliably large samples. The large quantity of data recorded for the most common domestic species allow an approach to the animal husbandry strategies employed by the herders of Alepotrypa. Given the enhanced suitability of the cave environment at the site, dairying is specifically examined through age-at-death data. Other archaeological lines of evidence suggest that large groups of people may have congregated seasonally at Alepotrypa, and this possibility is also investigated here through zooarchaeological data. Beyond strictly economic matters, social and cultural issues are explored in this

chapter, as well as the Neolithic environment around Alepotrypa.

Materials and methods

The excavation history of the site spans over four decades; thus, the collection strategy for the faunal material has inevitably changed through time. In general, and for most of the time, the site's macrofaunal remains were recovered through hand collection. Coarse dry-sieving was introduced on a regular basis from the late 1980s until 2013, when the excavations were concluded. Due to the nature of the site (*i.e.*, located in a cave), work was so carefully conducted since the late 1970s as to result in good rates of recovery for small animals and small anatomical elements. This claim is supported by the presence in the assemblage of large numbers of newborn animals (mainly sheep, goat and pig), as well as some remains of small mammals (*e.g.*, cat, marten, hedgehog and hare) and birds. However, some loss of small anatomical elements and smaller species is inevitable, as has been proven also in the case of the micromammal remains (Papayiannis, this volume). The extent of the loss is evaluated and discussed wherever relevant in the next two sections of this chapter. Nonetheless, in comparison to most open-air Neolithic sites in Greece, the preservation at Alepotrypa is exceptional. This allows a high degree of identifiability and contributes substantially towards a reliable representation of species and age categories. In the stable cave environment, individual bone density plays a less definitive role in preservation than it does in most open-air sites.

The material was processed at the Ephorate of Palaeoanthropology-Speleology of south Greece and studied at the Wiener Laboratory (American School of Classical Studies at Athens). During the study,

identification was facilitated by the comparative faunal collections of the Wiener Laboratory and the Fitch Laboratory (British School at Athens), as well as published anatomical atlases (*e.g.*, Schmidt 1972; Barone 1976; Pales and Garcia 1981; Cohen and Serjeantson 1996; Bocheński and Tomek 2009). For the distinction between sheep and goat remains, besides reference specimens available in the two aforementioned comparative collections, the relevant publications by Boessneck *et al.* (1964), Zeder and Lapham (2010), Kratochvil (1969) and Prummel and Frisch (1986) for postcranial remains and those of Balasse and Ambrose (2005), Halstead *et al.* (2002) and Payne (1985) for mandibular teeth were also consulted. The material had already been extensively sorted and partly studied by Thanos Webb, whose prior work on the assemblage has greatly facilitated this study.

For mammals, the anatomical units systematically recorded were: horncore/antler bases; mandible/loose cheek teeth; atlas; axis; scapula; proximal and distal halves of humerus, radius, femur, tibia, metapodia (only III and IV in pigs and II–V in canids); proximal half of ulna; pelvis; astragalus; calcaneum and phalanges 1–3 (excluding lateral phalanges in pigs and phalanges of metapodium I in canids). No attempt has been made to distinguish phalanges into fore- and hind-limb. These anatomical elements have been selected for their durability, identifiability and potential to yield information on human–animal relationships. The quantification of anatomical elements, taxa, age and sex is based on the minimum number of anatomical units (MinAU hereafter) and of butchery and taphonomy on the maximum number of anatomical units (MaxAU hereafter), in both cases according to Halstead (2011). To allow reliable comparisons between species with different numbers of foot bones, pig metapodia have been divided by two and canid metapodia by four, thus becoming analogous to the single metapodium per foot in sheep, goat, cattle and red deer. For the same reason, canid phalanges have been divided by two. Moreover, in order to avoid an underestimation of species that do not have horns or antlers, those anatomical units have

been excluded from analyses on species composition. No adaptations were necessary for any other species due to the absence of metapodia and phalanges (or presence only of single specimens). Due to their small number and the limited experience of the author in their study, avian and chelonian remains have been recorded only in terms of number of identified specimens (NISP) instead of MinAU.

Age-at-death was estimated based on the eruption and wear state of teeth, as well as the epiphyseal fusion state of postcranial elements. Eruption and wear stages of mandibular dental remains were recorded following Payne (1973, 1987) for sheep and goats, Grigson (1982) and Halstead's (1985) adaptation of Payne for cattle, Grant (1982) and Bull and Payne (1982) for pig, and Brown and Chapman (1991) for red deer. Eruption ages for mandibular teeth of dog and cat follow Silver (1969), while the attribution of age-at-death based on the wear of dog permanent mandibular M1 follows Horard-Herbin (2000). During quantification, dental specimens attributable to more than one age interval were proportionately assigned. For the rest of the identified species there is little available information concerning eruption and wear. Nevertheless, wherever possible, age-at-death was attempted either in relative terms (*i.e.*, permanent dentition worn = adult) or based on relevant published data such as Linhart (1968) on fox and Lüps and Roper (1988) for badger. Age-at-death based on epiphyseal fusion follows Silver (1969) for sheep, goat, cattle and pig, while for the rest of the identified species, samples are too small for elaborate analysis. Pelves of sheep and goat were sexed whenever possible based on their morphology following Boessneck *et al.* (1964) and those of cattle following Grigson (1982). Sex ratios for pig were estimated based on the sexually dimorphic morphology of the permanent mandibular canine (Mayer and Brisbin 1988). Fragmentation, taphonomy and butchery were recorded as described in Halstead (2011) and biometric measurements were taken following von den Driesch (1976), with the addition of the measurements in Table 14.1.

Table 14.1. Additional biometric measurements taken on Alepotrypa faunal material

Element	Name	Description	Reference
Scapula	ASG	Shortest distance from base of spine to edge of glenoid	Boessneck <i>et al.</i> (1964)
Humerus	HTC	Minimum diameter of trochlea	Payne and Bull (1988)
	HT	Greatest height of trochlea	Boessneck <i>et al.</i> (1964)
Pelvis	MRDA	Depth of medial rim of acetabulum	Davis (1996)
Calcaneus	GD	Greatest depth	Albarella and Payne (2005)
	WCM	Medio-lateral width of medial condyle	Payne (1969)
	WCL	Medio-lateral width of lateral condyle	
	DVM	Antero-posterior diameter of medial verticillus	Boessneck <i>et al.</i> (1964)
Metacarpus/ metatarsus	DVL	Antero-posterior diameter of lateral verticillus	
	DEM	Antero-posterior diameter of medial external trochlea	
	DEL	Antero-posterior diameter of lateral external trochlea	
	BFp	Greatest breadth of proximal articular surface	Davis (1996)
	BFd	Greatest width of the distal articulation	

Results

Taxonomic composition

The study of the mammal remains yielded 4562 MaxAU and 3804 MinAU. Beyond mammalian remains, the assemblage also contained a few bird (NISP = 18) and reptile (NISP = 68) remains. Besides the mammalian, avian and chelonian fauna discussed in this chapter, the microfaunal and ichthyofaunal remains recovered at Alepotrypa are presented and discussed in separate chapters in this volume by Papayiannis and Theodoropoulou respectively.

The mammal species present and their frequencies have the potential to shed light on the role and importance of each one of them at Alepotrypa. The largest datasets derive from Chambers B, D, A and Z. The material from each chamber has been analysed separately in order to explore any differences between chambers. For some analyses, samples have been grouped on a chronological basis, wherever they were too small to be analysed individually. The main periods represented are the Early, Late and Final Neolithic.

Starting in chronological order, there are two samples, from Chambers A and B dated to the Early Neolithic occupation of the cave (*i.e.*, c. 6000 cal BC). Their mammalian compositions are presented in Figures 14.1 and 2 respectively. The sample from Chamber A (Figure 14.1) is safely dated to the Early Neolithic, as later deposits have been truncated by earlier archaeological operations in the cave. Despite its modest size (MinAU = 263), ten

mammalian species are represented. Taking into account the possibilities that wild boar might be present among pig remains and wolf and/or jackal among dog remains, the number of species could be raised to 12 or 13 species. More than half of the sample (62.0%) belongs to sheep (*Ovis aries*) and goat (*Capra hircus*) combined. Sheep and goat are represented in relatively balanced proportions, although sheep are slightly more abundant. Beyond sheep and goat, the only other economically important species is the pig (*Sus domesticus*) at 18.6%, with the probable presence of a few wild boar (*Sus scrofa*) remains. Cattle (*Bos taurus*) remains represent only 4.9% of the assemblage. Beyond these four species, dog (*Canis familiaris*) is unexpectedly abundant (10.3%) in the sample. This raises questions about its role at the site, assuming that all or most of those remains indeed belong to dogs and not, also, to wolves (*Canis lupus*) and/or jackals (*Canis aureus*). In addition to the potential occurrence of wild boar, wolf and jackal, other wild species are definitely present in the sample, but their economic importance appears to have been limited, as their low combined percentage (4.2%) suggests. Red deer (*Cervus elaphus*) was present, as well as fox (*Vulpes vulpes*), badger (*Meles meles*), hare (*Lepus europaeus*) and possibly another small carnivore (smaller than a fox). Chamber A is the nearest to the cave's entrance and this raises the possibility that some of these animals have ended up in the assemblage due to factors other than interaction with humans. Some of these species

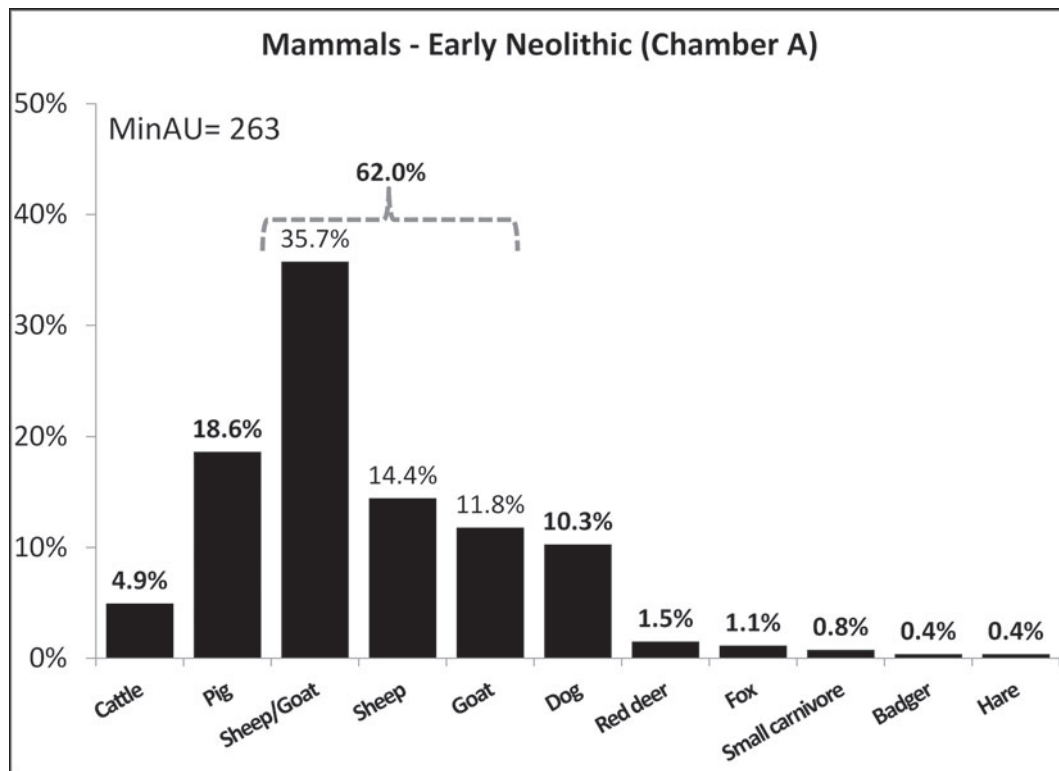


Figure 14.1. Mammalian species composition from Chamber A.

frequently visit caves (e.g., badgers and foxes) while others (e.g., hare and red deer) may have ended up there as hunted or scavenged prey. Nevertheless, strong indications (e.g., in the form of butchery marks) exist to suggest that at least most remains were brought to the cave and utilised by humans, possibly as the result of hunting or trapping activities.

The presence of five bird remains in Chamber A is also of interest. It can be confirmed that at least three species of bird are represented in Chamber A (Table 14.2), the jackdaw (*Corvus monedula*) and possibly another corvid species, a strigiform species (possibly little or tawny owl, *Athene noctua*/*Strix aluco*), and finally a gruiform or ciconiiform species. In addition, an unidentified specimen of a medium-sized bird could belong to any of the above or to an entirely different species. From these species, the gruiform/ciconiiform species is likely – but not certainly – the result of human predation, while corvid and strigiform species are more likely to have dwelt inside the cave or near its entrance.

Table 14.2. Bird species from Chamber A (EN)

Species	NISP
Strigiformes	1
Corvidae	1
<i>Corvus monedula</i>	1
Gruiformes/Ciconiiformes	1
Medium-sized bird	1
Total	5

The Early Neolithic sample from Chamber B is quite small (Figure 14.2). Nevertheless, its faunal composition is compatible with its coeval sample from Chamber A in that sheep/goat account for about 60% of the sample, with an even clearer majority of sheep over goats. Pig is more abundant than in Chamber A, cattle and dog are less so, while red deer is consistently present in small numbers.

The next chronological period for which a reliably large sample is available (MinAU = 463) is the Late Neolithic, represented in Chamber B (Figure 14.3). It should be mentioned that the levels from which the sample derives are not entirely safely attributed to the Late Neolithic (c. 5,500–4,500 cal BC), although other contextual and stratigraphic indications do support this chronology. Overall, the faunal composition is similar to that of the preceding Early Neolithic samples, but there are also notable differences. Sheep/goat percentage increases to almost 70% with a clear predominance of sheep over goats, while pig and cattle remain secondary in economic importance at slightly reduced percentages compared to the Early Neolithic samples. Dog remains are significantly reduced to 1.1%. Red deer represents 3.5% of the sample; a range of smaller wild species are represented such as fox, marten (probably stone marten, *Martes foina*), cat (*Felis catus/silvestris*), hedgehog (possibly *Erinaceus roumanicus*) and hare. Despite the small numbers of wild species, the presence of some of them is intriguing. For example, it is unknown whether the cat was a domestic or

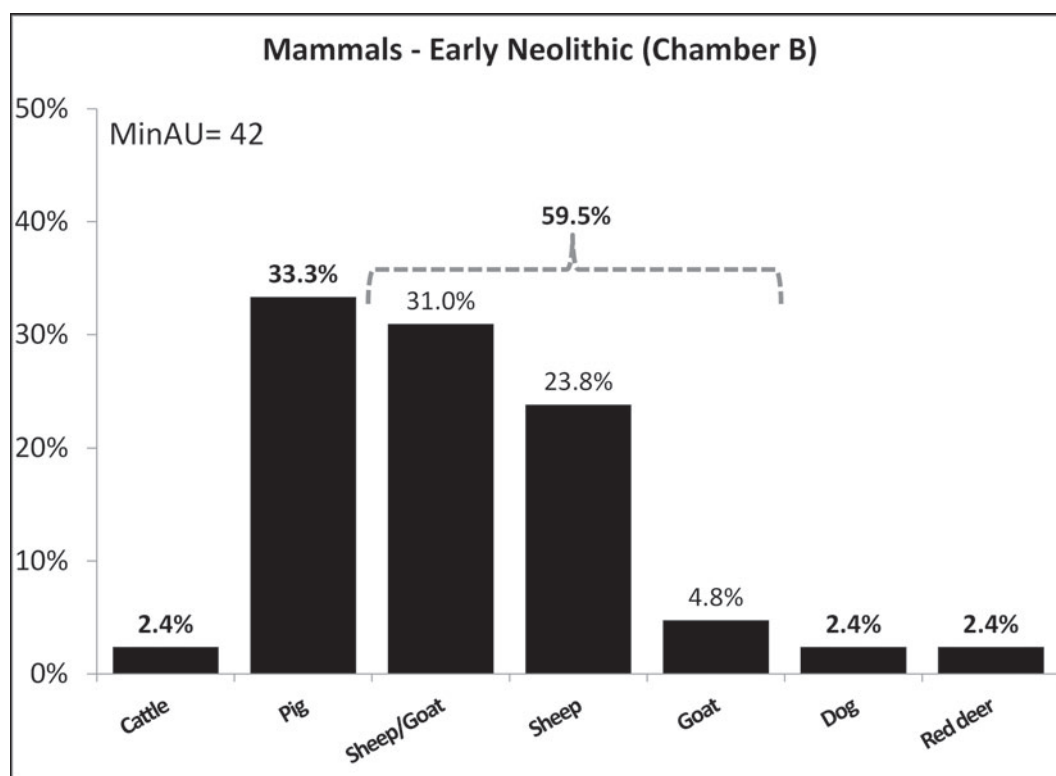


Figure 14.2. Mammalian species composition from Early Neolithic levels of Chamber B.

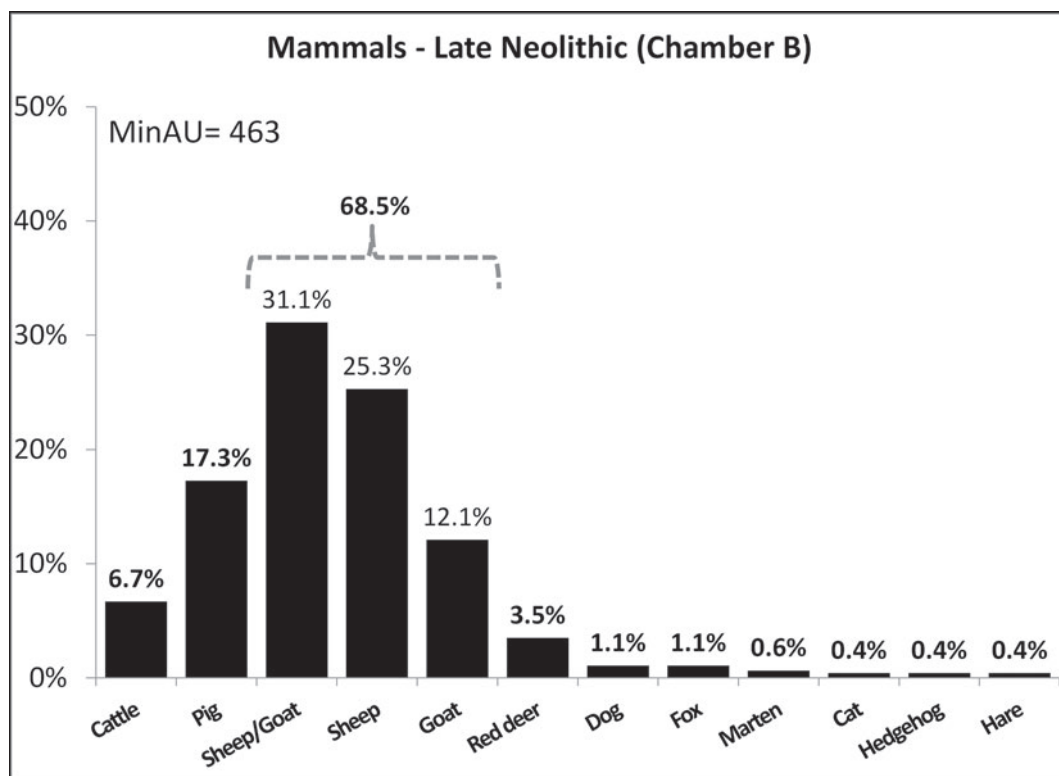


Figure 14.3. Mammalian species composition from Late Neolithic levels of Chamber B.

a wild animal. Butchery marks on the proximal humerus of the specimen can be read as evidence for the latter scenario, but such a reading is far from safe, as butchery marks have also been recorded on domestic dog remains. The traces of butchery on wild carnivores such as fox, badger and marten in this and other samples suggest that the occupants of Alepotrypa were hunting or trapping such animals for their pelts, if not also for their meat. Hares were also occasionally captured as the butchery marks on their bones indicate.

The sample from the Final Neolithic levels (c. 4,500–3,200 cal BC) in Chamber B is the largest available from Alepotrypa (MinAU = 1614). In this sample (Figure 14.4) sheep/goat reach 71.7%, thus confirming the trend for an increase in their abundance from the Early to the Late Neolithic. This increase is mainly at the expense of cattle and wild species, while the pig percentage remains stable at just below 20.0%. Despite their low abundance, many wild species have been identified, including red deer, fox, hare, badger, cat, stone marten, hare, hedgehog and possibly wolf, jackal, wild boar and a mustelid species, other than the stone marten. Many of the remains of these species bear butchery marks and it can thus be safely assumed that they were hunted or trapped by humans and brought to the cave. As was the case concerning the cat specimen in the Late Neolithic sample from Chamber B, cat remains in this sample also had butchery marks on them. The only wild species that consistently lacks any signs of butchery is the hedgehog but this does not

necessarily exclude its consumption as there is little need to heavily butcher such a small animal.

In addition to the Late and Final Neolithic samples from Chamber B, another sample is broadly dated to both periods (c. 5,500–3,200 cal BC). The species composition of this sample (Figure 14.5) is similar to that of the Final Neolithic sample from the same chamber; a near-absolute predominance of sheep/goat (79.3%), a secondary role for the pig (13.5%) and marginal roles, at least economically, for cattle and wild species. The similarity between this and the Final Neolithic sample from the same chamber suggests that it might be chronologically nearer to the Final than the Late Neolithic.

The Late and Final Neolithic samples from Chamber B also yielded a small number of bird remains, which are presented combined in Table 14.3. Crane (*Grus grus*) has been positively identified in this sample, as well as two specimens belonging to pigeon (unknown if wood or rock pigeon), a specimen attributable to a species of gull, three to a galliform species (possibly partridge) and two to accipitriform species. Moreover, four specimens of medium-sized birds remain unidentified.

The Late and Final Neolithic samples have also yielded reptilian (exclusively chelonian) remains. Both marine turtles and land tortoises (Table 14.4) are represented in the sample. The only definitively identified species is the loggerhead sea turtle (*Caretta caretta*). It cannot be confirmed that all sea turtle remains belong to the loggerhead, but it is a likely

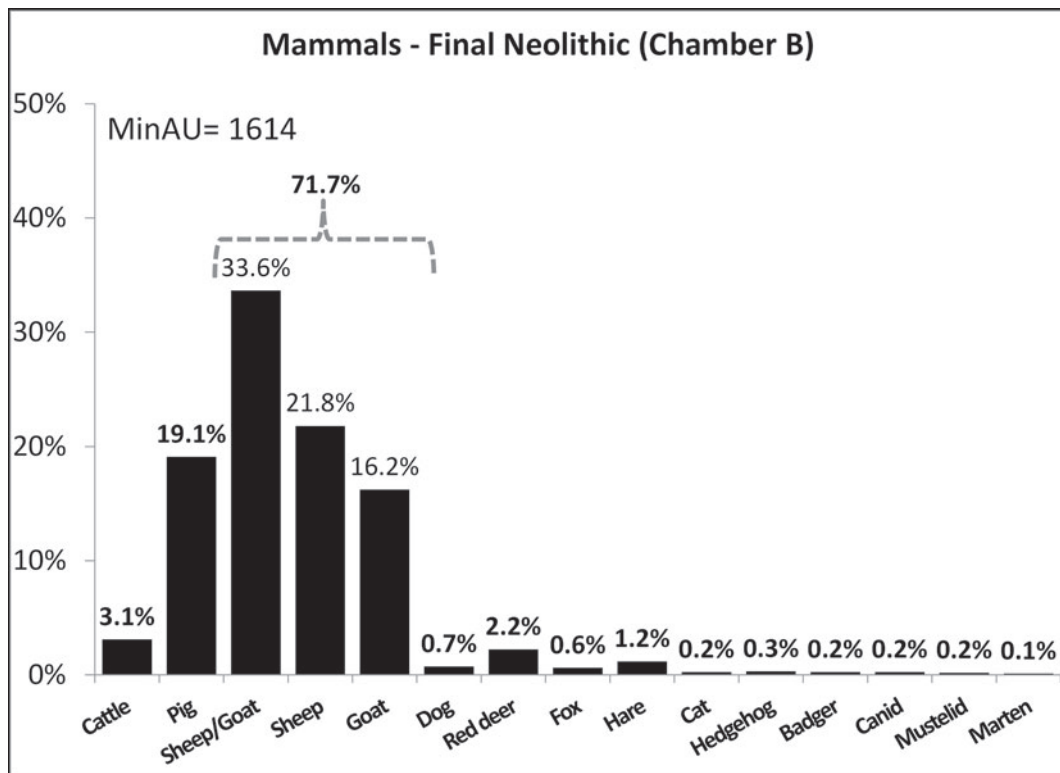


Figure 14.4. Mammalian species composition from Final Neolithic levels of Chamber B.

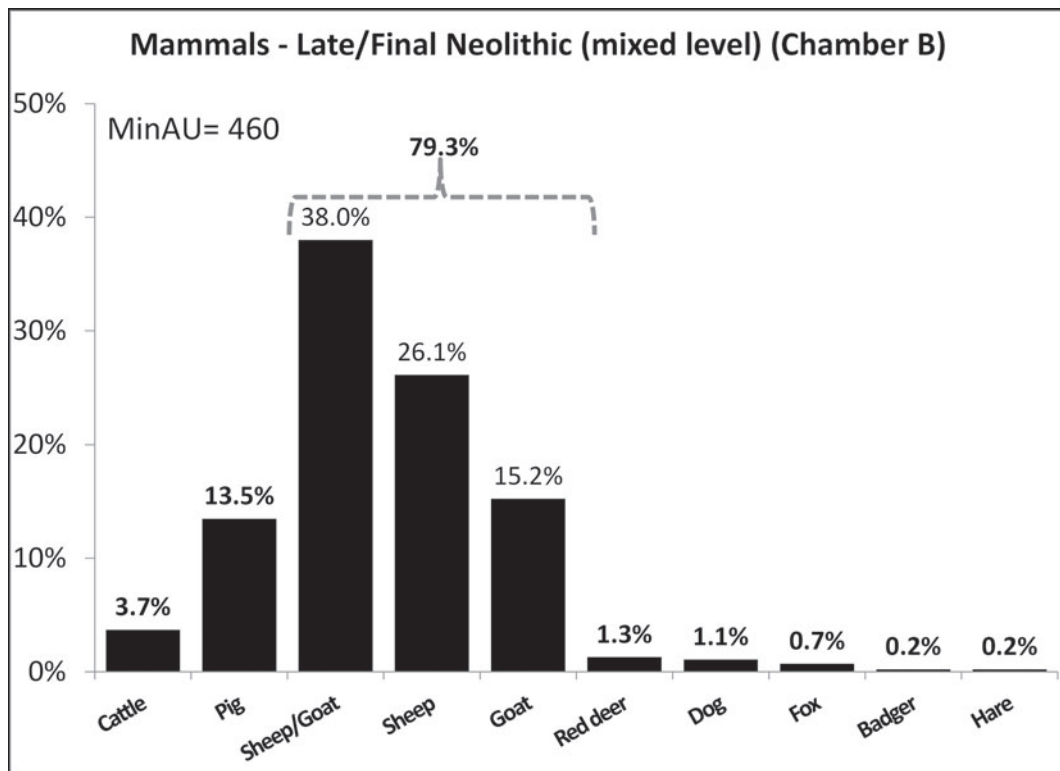


Figure 14.5. Mammalian species composition from Late/Final Neolithic levels of Chamber B.

Table 14.3. Bird species from Late-Final Neolithic Chamber B

Taxon	NISP
<i>Grus grus</i>	1
Galliformes	3
<i>Columba</i> sp.	2
Accipitriformes	2
<i>Larus</i> sp.	1
Medium-sized bird	4
Total	13

Table 14.4. Reptilian (chelonian) remains from Late-Final Neolithic Chamber B

<i>Taxon</i>	<i>Anatomical element</i>	<i>NISP</i>	<i>Comments</i>
<i>Marine turtle remains</i>			
<i>Caretta</i>	Carapace (Nuchal)	1	Most or all belong to 1 individual
<i>caretta</i>	Carapace (Pleural)	8	
	Carapace (Peripheral)	9	
	Carapace (Neural)	1	
	Carapace (Suprapygal)	1	
Marine turtle	Carapace (Pleural)	2	1 individual
	Carapace (Peripheral)	2	
	Plastron	12	
	Plastron	1	Unknown part of any of the above individuals
Total		37	
<i>Land tortoise remains</i>			
<i>Testudo</i> sp.	Carapace (Pleural)	4	1 individual
	Carapace (Pleural)	9	
	Carapace (Peripheral)	1	1 individual
	Carapace (Pleural)	11	Mixed, unknown parts of any of the above individuals
	Carapace (Neural)	1	
Total		26	

scenario since it is the only identified species. All land tortoise identifications remain on the generic *Testudo* sp. as it is difficult, at least with the author's skills in the identification of chelonians, to distinguish between the three similar species of land tortoise currently present in Greece, *i.e.*, Hermann's (*Testudo hermanni*), marginated (*Testudo marginata*) and spur-thighed (*Testudo graeca*). For both sea turtles and land tortoises, only anatomical elements that form part of the shell (*i.e.*, carapace and plastron) have been recorded.

Like Chamber B, Chamber D has also produced a sample dated to the Final Neolithic period. Its faunal composition (Figure 14.6) is quite similar to its coeval sample in Chamber B; a clear predominance of sheep/goat (75.2%) with a strong sheep predominance within that taxon. The secondary, although still important, economic role for pigs and the rather marginal role for cattle are confirmed for Chamber D as well. As in other Late and Final Neolithic samples, dog remains are scarce, around 1%. Wild species are rare but the range of species present is relatively consistent with other chambers.

In Chamber D, red deer, fox, hare, cat, hedgehog and marten are also present, thus providing further evidence for the scenario that the remains of these animals were deposited in the cave by humans. Beyond mammals, four land tortoise specimens (*Testudo* sp.) were identified, possibly belonging to the same individual. Moreover, as was the case with the rest of the chelonian remains, all four specimens from Chamber D (one nuchal and one pleural bone from the carapace and two more specimens from the plastron) derive from the tortoise's shell without any limb bones present.

The broad chronological range of the material recovered from Chamber Z dictates that the sample is generally attributed to the Early-Final Neolithic period (*i.e.*, c. 6,000–3,200 cal BC). Despite the broad chronological span and small size (MinAU = 152), the sample is worth analysing due to the peculiar context from which it was recovered. The excavated matrix was black and mostly consisted of animal dung (see Karkanas, this volume) and, besides animal bones, a large number of whole, but deliberately broken, ceramic vessels of different types were also recovered. The faunal composition of Chamber Z (Figure 14.7) consists mainly of sheep and goat (80.9%) and, once again, a clear predominance of sheep within that taxon. The pig percentage (15.8%) confirms that a 15–20% range was a constant for this species (possibly with some wild boar remains included) from the Early through to the Final Neolithic. Beyond sheep, goat and pig, other species (*i.e.*, cattle, red deer, dog and hare) are barely present. In this sense, Chamber Z is different but not entirely out of the ordinary, as its overall species composition is reminiscent of the Final Neolithic samples (Figures 14.4 and 6). This similarity can be considered as evidence for a Final Neolithic date of the sample. Beyond mammals, a single land tortoise (*Testudo* sp.) specimen that derived from the carapace (pleural bone) was also recorded.

Besides the substantial samples from Chambers A, B, D and Z, a few faunal remains have also been recovered from other parts of the cave such as the Lake chamber and the 'Neolithic staircase', both in contexts of Final Neolithic chronology. The total MinAU from the Lake Chamber is 34 and consists of three pig and 31 sheep/goat anatomical units, with a strong sheep majority, as has been the case for other Final Neolithic contexts in the cave. The material from the 'Neolithic staircase' consists of five pig, 15 sheep/goat (with equal sheep and goat representation) and one red deer anatomical units. These contexts are too small to offer any significant insights, but they nevertheless show that animal remains were also deposited in those locations by the Final Neolithic occupants of the cave.

The results on a chamber-by-chamber basis presented above allow comparisons that may reveal diachronic patterns in human-animal interactions at Alepotrypa, especially between the Early and Late/Final Neolithic phases. A notable trend is the increase in sheep/goat

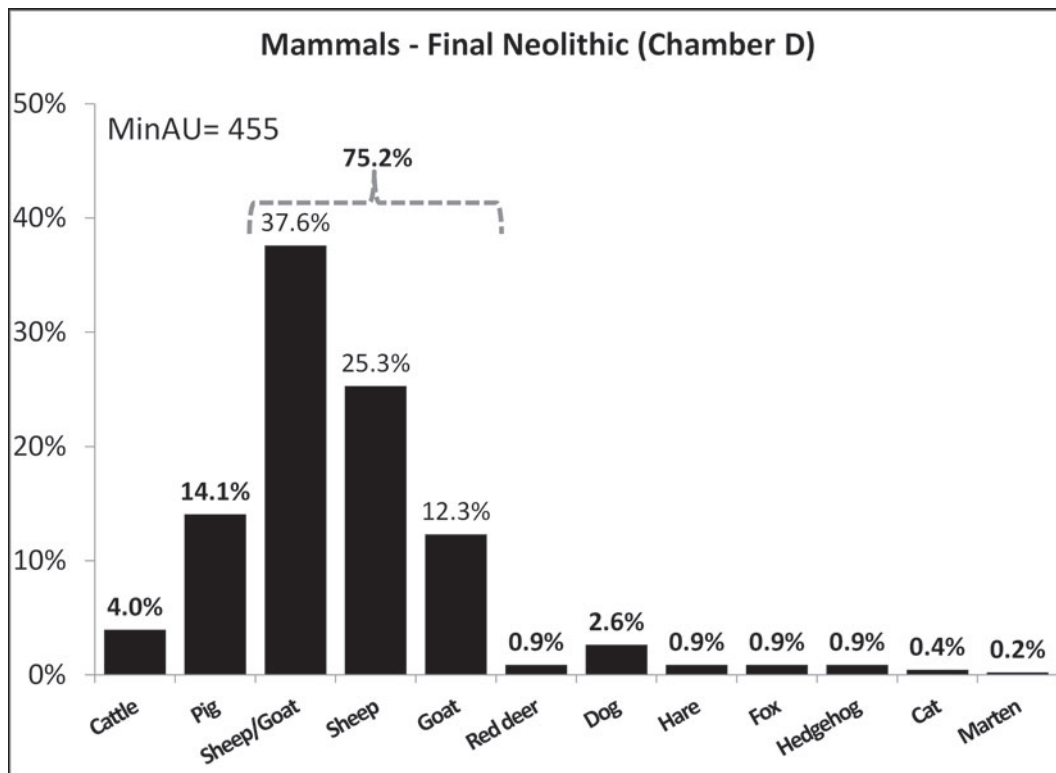


Figure 14.6. Mammalian species composition from Final Neolithic levels of Chamber D.

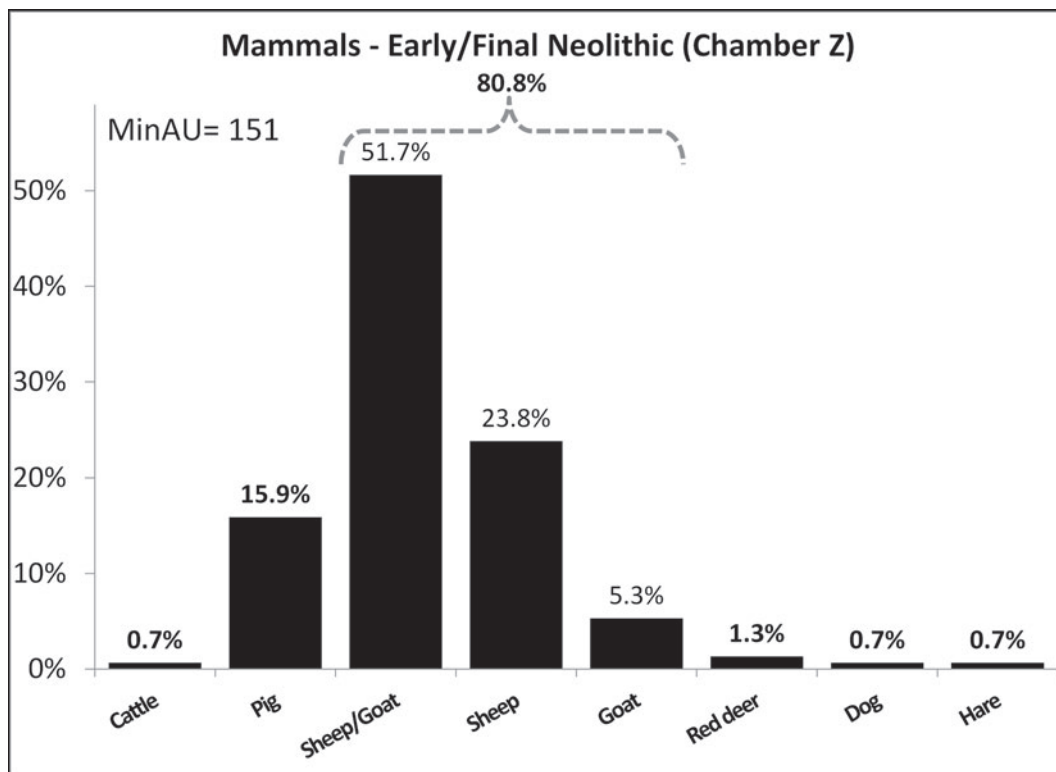


Figure 14.7. Mammalian species composition from Early/Final Neolithic deposits in Chamber Z.

abundance from the Early to the Late and then to the Final Neolithic phases. Moreover, within the sheep/goat category, sheep are consistently more abundant than goats throughout the sequence, but their representation tends to become more balanced in the Late and Final Neolithic periods. Pig percentages appear to be remarkably stable throughout the sequence with percentages in the 15–20% range (Figures 14.1, 14.3–7), with the exception of the small Early Neolithic sample from Chamber B, which yielded a significantly higher percentage (Figure 14.2). Cattle played a rather restricted role with percentages ranging from 3% to 7% and are at their lowest in Final Neolithic samples. In Chamber Z in particular, cattle are almost absent, although the chronological span of this sample is broad (Early-Final Neolithic). The domestic dog is also without fail present in all the samples, but is more abundant in the Early than the Late and Final Neolithic samples. The high dog percentage in Early Neolithic Chamber A, combined with a butchered dog humerus and increased numbers in the context of the ossuary, can be used as evidence to suggest additional roles for dogs other than their usual guard and shepherd ‘duties’. The possibility of wolf or jackal remains included among those of dog is open due to their close morphological similarity. This issue is further explored biometrically later on (Figure 14.18).

Anatomical representation

The anatomical representation (see breakdown of anatomical units per species in Appendix 14.1) shows that all body parts were present at the site, at least for the main species (*i.e.*, sheep, goat, pig and cattle). The same can be suggested for the rarer species but it cannot be confirmed, except perhaps for the cases of dog and red deer where most parts of the skeleton are well-represented. Despite the presence of all body parts in the assemblage, there is a consistent ‘shortage’ of small-sized anatomical elements. Phalanges, astragalus, calcaneus and ulna numbers are particularly low compared to those of long bones. Possible explanations for this pattern include the complete destruction of more of the smaller anatomical elements through gnawing, their disposal in an as yet unexcavated location outside the cave and the higher chance of their being overlooked during work in the trench or in the dry sieve (*cf.* Payne 1972). The last explanation is likely to be the primary reason for the observed pattern as most material was hand-collected, thus making size an important factor in any faunal remains being collected. This explanation is also supported by the observation that small anatomical elements of large species, such as cattle and red deer, are proportionately well-represented when compared to long bones, in contrast to species of medium size such as pig, sheep and goat (Appendix 14.1). Other indications that support a size-related recovery bias include the near-

absence of small anatomical elements of small species such as dog, fox, badger, marten, cat, hare and hedgehog, as well as the near-absence of small anatomical elements of neonatal pig, sheep and goat, despite the otherwise large number of long bones of neonatal animals in the assemblage. Nevertheless, the bias against small body parts is not as severe as the data suggest (Appendix 14.1). Moreover, it is probable that other factors contributed to it, such as loss of small bones through gnawing and the possibility of discarding some lower leg bones at locations outside the cave or at kill sites (in the case of hunted animals). Interestingly, there is also a shortage of pig mandibular remains in many samples (*e.g.*, Final Neolithic Chamber B). Summing up the anatomical representation data, it is likely that smaller species are slightly under-represented, while cattle are slightly over-represented. The effect on the overall picture of species frequencies, however, is only a mild one, since the overwhelming majority of the assemblage consists of sheep, goats and pigs (*i.e.*, animals of medium size).

Age-at-death

Sheep and goat

Age-at-death was analysed based on two lines of evidence, epiphyseal fusion and dental eruption and wear. As with species frequencies, age-at-death data were analysed with respect to their chronology and on a chamber by chamber basis. In some cases the combining of chronologically analogous samples from different chambers (or contexts within chambers) was preferred over the analysis of small samples.

The large number of sheep and goat remains yielded six separate samples amenable to analysis of age-at-death data. Before proceeding with the analysis of epiphyseal fusion data, and due to the substantial numbers of neonatal remains, all aged remains were divided into neonatal and post-neonatal (Table 14.5). It is entirely possible that some of the specimens recorded as neonatal are foetal. Neonatal remains are most abundant in Early Neolithic Chamber A (11%) and Late/Final Neolithic Chamber B (12%), while in Late Neolithic Chamber B (5%) and Early/Final Neolithic Chamber Z (3%) they exhibit lower percentages. Final Neolithic Chamber D yielded 6% of neonatal remains while Final Neolithic Chamber B, the largest and most reliable sample in the assemblage, yielded 8%. The recovery bias against the smaller bones, such as those of neonatal animals, means that neonatal remains are probably under-estimated. The degree to which this is true cannot be assessed precisely, but it is unlikely that the observed percentages are too far from reality as most neonatal long bones were complete or in large pieces, which reduces the likelihood of their being missed in the trench or dry sieve.

All aged post-neonatal sheep and goat (combined) remains were further analysed based on their epiphyseal

Table 14.5. Postcranial data for neonatal vs post-neonatal mortality in sheep and goat (combined)

Chamber – chronology	Neonatal		Post-neonatal		Total
	MinAU	MinAU%	MinAU	MinAU%	MinAU
A – Early Neolithic	9	11	71	89	80
B – Late Neolithic	8	5	167	95	175
B – Late/Final Neolithic	23	12	171	88	194
B – Final Neolithic	56	8	656	92	712
D – Final Neolithic	13	6	211	94	224
Z – Early/Final Neolithic	2	3	61	97	63
Total	111	8	1337	92	1448

fusion state. The produced results are useful in the interpretation of sheep and goat husbandry practices at Alepotrypa (Figure 14.8). The only substantial Early Neolithic sample from Chamber A is of modest size; it indicates high mortality in the first year (58%) and again between two and four years (reaching 90%). Chronologically, the next is the Late Neolithic sample from Chamber B which shows a similar pattern with somewhat lower mortality peaks (41% and 73% respectively). The sample dated to the Late/Final Neolithic from Chamber B demonstrates similar mortality (46%) in the first year, but the second peak (80%) takes place at a younger age than the previous two samples, *i.e.*, by 18–28 months instead of 30–42 months. An almost identical pattern is produced by analysis of the largest single sample, that of Final Neolithic Chamber B (Figure 14.8). The coeval sample from Chamber D has produced a very similar result with somewhat lower mortality in the first year (29% instead of 47%). The coarsely dated (Early–Final Neolithic) sample from Chamber Z is small and of limited reliability, but exhibits a different pattern from all other samples in that the main mortality occurs between 10 and 16 months. Overall, all graphs consistently show high mortality in the first year (especially if neonatal remains are added to the picture) and 10–25% survivorship beyond the 30–42 months interval.

Possible differences in mortality between sheep and goat can be explored through the mandibular eruption and wear data. Only a few samples yielded enough data for the production of mortality profiles and, in all cases, data from multiple chambers or chronological periods had to be combined to increase the sample size. Early Neolithic data are scarce and, even with the combination of Chambers A and B, only 7 sheep and 7 goat mandibles contributed to the analyses. Nevertheless, the two mortality profiles produced (Figure 14.9) are quite similar with peaks in the 1–2 and 3–4 years intervals. Moreover, some mortality in the first year can be confirmed for both sheep and goat.

The combination of all Late and Final Neolithic data from Chamber B amounts to the largest dataset from a single chamber for both species. The analysis reveals different mortality patterns for sheep and goat (Figure 14.10), which shows that these two species were probably managed under different husbandry strategies.

The main difference lies in that goat mortality is much higher in the first year (60%) while sheep mortality is less than half of that (27%). Within the first year, mortality is similar between sheep and goat in the 0–2 months interval (6% and 8% respectively), but in the 2–6 months interval sheep mortality is only half that of goat (8% and 16%) and in the 6–12 months the difference widens further with 13% mortality for sheep and 36% for goats. The main mortality peak for sheep is in the 1–3 years interval (25% for 1–2 and 15% for 2–3 years), while for goats, beyond the main peak at 6–12 months (36%), there is a secondary peak in the 2–3 years interval (21%). Sheep also have a secondary peak in the 4–6 years interval (20%), while for both species survival beyond 6 years is rather low (3–4%). Unfortunately, all other samples are too small for reliable analysis.

Pig

As was the case with sheep and goat, the assemblage contained significant numbers of pig neonatal remains. In order to explore the extent and significance of neonatal mortality, all aged anatomical units were divided into neonatal and post-neonatal (Table 14.6). The absence of neonatal remains in the Early Neolithic samples cannot be considered reliable as the sample is tiny. The Late Neolithic and Late/Final Neolithic samples from Chamber B are somewhat larger and both suggest neonatal mortality around 10%. The largest and most reliable sample from Final Neolithic Chamber B exhibits 25% neonatal mortality, which is the highest in the assemblage. Interestingly, its coeval small sample from Chamber D did not yield any neonatal remains. The smallest sample (Early/Final Neolithic Chamber Z) contained a single neonatal anatomical unit which amounts to 7% of the sample.

As Table 14.6 shows, few samples of aged postcranial remains are large enough to justify further analysis. The Early Neolithic samples only contained 18 aged anatomical units (16 from Chamber A and 2 from Chamber B), which were all unfused, thus indicating the presence of predominately immature animals. The results of the Late, Late/Final and Final Neolithic samples from Chamber B, as well as the Final Neolithic sample from Chamber D, show similar results with particularly high

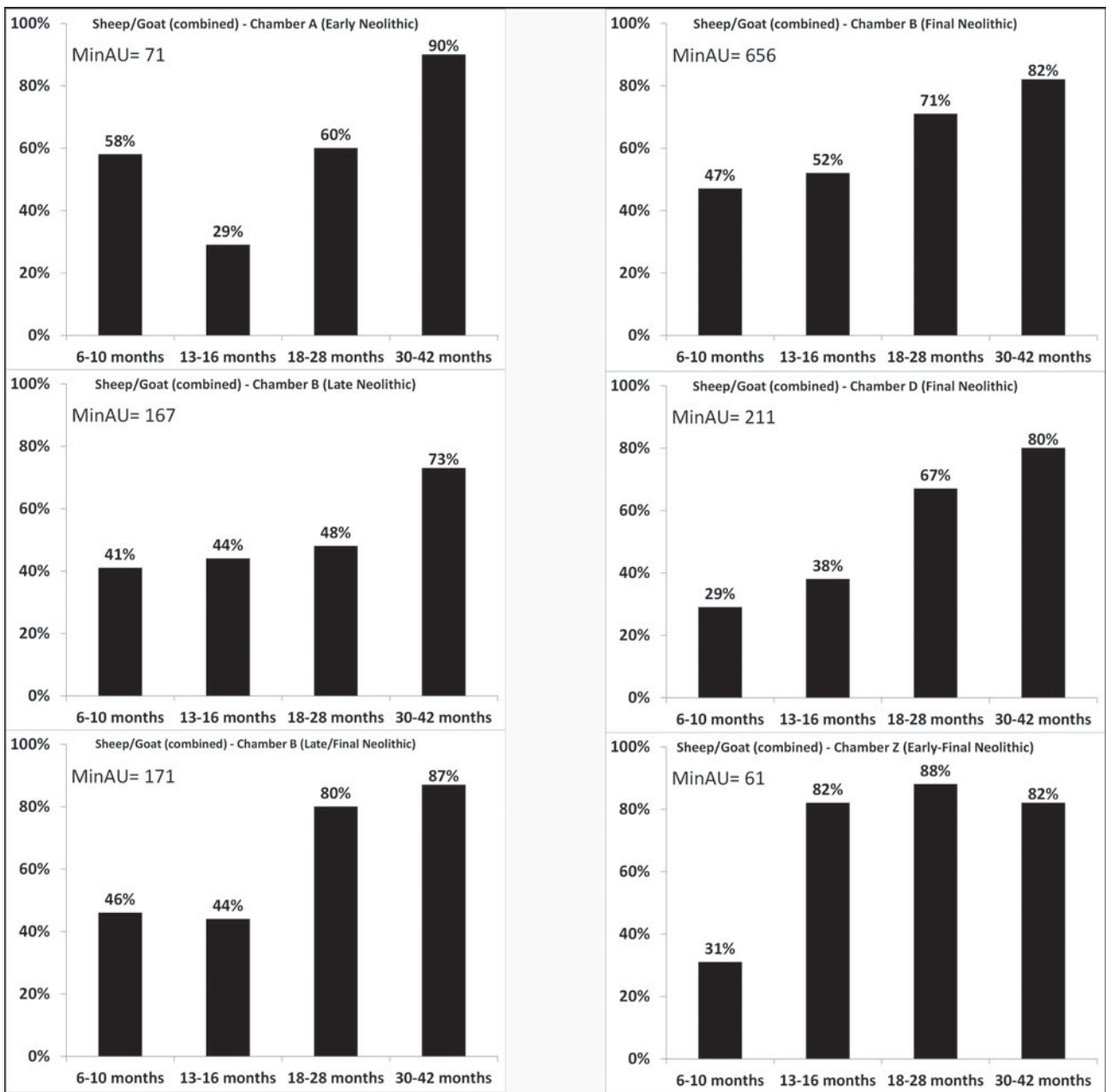


Figure 14.8. Mortality data for sheep and goat (combined) based on epiphyseal fusion. Neonatal remains are excluded (see Table 14.5).

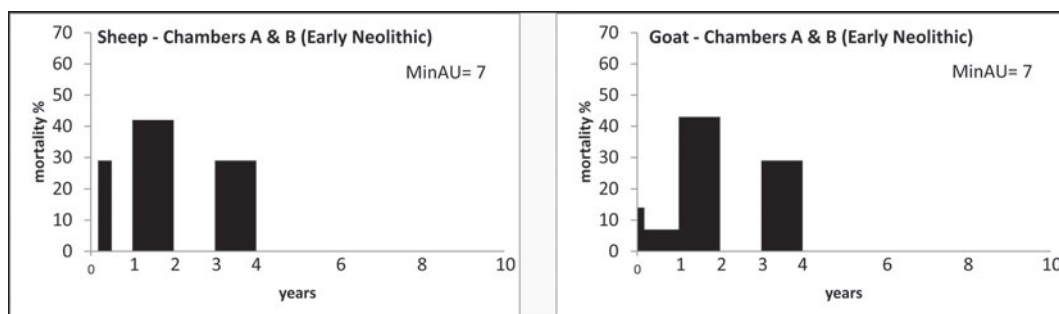


Figure 14.9. Mortality data for sheep and goat based on dental eruption and wear, Early Neolithic period.

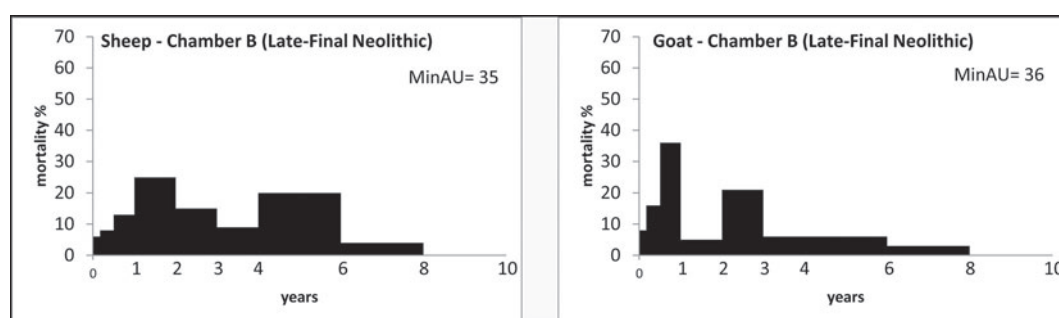


Figure 14.10. Mortality data for sheep and goat based on dental eruption and wear, Late-Final Neolithic period.

Table 14.6. Postcranial data for neonatal vs post-neonatal mortality in pigs

Chamber – chronology	Neonatal		Post-neonatal		Total MinAU
	MinAU	MinAU%	MinAU	MinAU%	
A and B – Early Neolithic	0	0	18	100	18
B – Late Neolithic	5	9	48	91	53
B – Late/Final Neolithic	5	11	41	89	46
B – Final Neolithic	57	25	170	75	227
D – Final Neolithic	0	0	39	100	39
Z – Early/Final Neolithic	1	7	14	93	15
Total	68	17	330	83	398

mortality in the first year (54–75%), around 80% by 30 months and 92–100% by 42 months (Figure 14.11).

Besides epiphyseal fusion, pig mortality was explored further through two samples of aged mandibular remains (Figure 14.12). The combination of Early Neolithic samples from Chambers A (MinAU = 9) and B (MinAU = 5) produced a profile with two main mortality peaks, one at 2–6 months (26%) and another at 1–2 years (36%). Overall, almost half the population was slaughtered within the first year (49%), which includes 10% in the first 2 months. Few animals were slaughtered, or hunted if wild, when 2–3 years (9%) or older (7%). The overall pattern does not change significantly in the combined Late, Late/Final and Final Neolithic samples from Chamber B, with an absence of mortality at 0–2 months, a slightly higher and slightly lower mortality at 2–6 months (38%) and 1–2 years (24%) respectively, and a higher survival of animals until 2–3 years (15%). Overall, dental data produce broadly similar results to those obtained by epiphyseal fusion data (Figure 14.11), although the latter slightly differ in that they exhibit higher mortality in the first year and, consequently, lower in older age intervals.

Cattle

As was the case for sheep/goat and pig, neonatal cattle remains are also relatively abundant (Table 14.7). Despite the overall scarcity of cattle in the assemblage, neonatal percentages show broadly similar patterns to those of sheep/goat (Table 14.5) and pig (Table 14.6). For cattle, just as for sheep/goat and pig, Late/Final and Final Neolithic samples from Chamber B consistently exhibit high neonatal mortality, while Final Neolithic Chamber D

a consistently low one. Pig exhibits overall the highest neonatal percentage in the assemblage (17%), followed by cattle (11%) and sheep/goat (8%).

Table 14.7 shows that aged cattle postcranial remains are scarce. The only substantial sample derives from Chamber B with the combination of the Late, Late/Final and Final Neolithic samples (Figure 14.13). As in sheep/goat and pig, mortality in cattle is high (50%) within the first year. By 18 months mortality reaches 74% while, taking into account the analyses of the 24–36 months (92%) and 36–48 months (81%) intervals, it can be suggested that around 10–20% of cattle survived beyond 2–4 years. It is also important to bear in mind that the scarcity of epiphyseal fusion data for cattle (*e.g.*, only two anatomical units are included in the 7–10 months interval) and the combination of chronologically different samples render the results described above tentative. Dental eruption and wear data are also scarce (MinAU = 7) but in accordance with epiphyseal fusion. Four anatomical units were aged at 8–18 months, one at 18–30, one at 30–36 and another belonged to a senile animal.

Other species

Age-at-death data for species more rarely encountered than sheep, goat, pig and cattle are scarce. Nevertheless, they have potential to offer some insight into the diversity of relationships developed between humans and animals. All estimations of age-at-death based on eruption and wear data for red deer, dog (also possibly including some jackal), fox, badger, cat, hare, marten and hedgehog are presented in Table 14.8. Concerning red deer, the data suggest the presence of both immature and adult

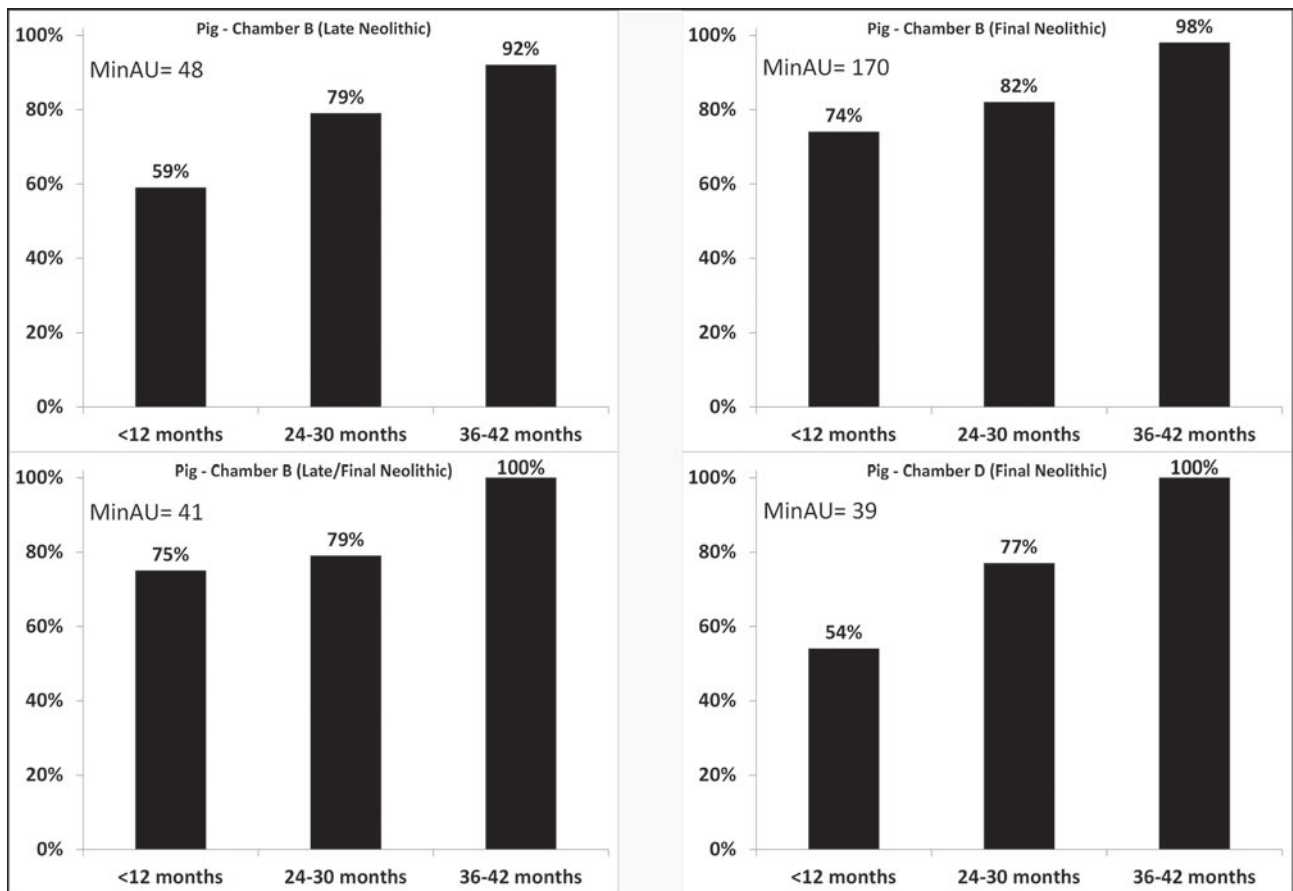


Figure 14.11. Mortality data for pig based on epiphyseal fusion. Neonatal remains are excluded.

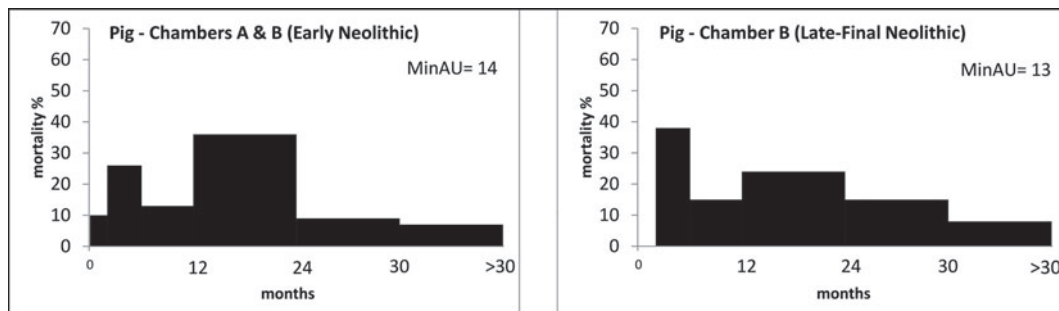


Figure 14.12. Mortality data for pig based on dental eruption and wear.

Table 14.7. Postcranial data for neonatal vs post-neonatal mortality in cattle

Chamber – Chronology	Neonatal		Post-neonatal		Total MinAU
	MinAU	MinAU%	MinAU	MinAU%	
A and B – Early Neolithic	0	0	5	100	5
B – Late Neolithic	2	12	15	88	17
B – Late/Final Neolithic	1	8	11	92	12
B – Final Neolithic	5	16	26	84	31
D – Final Neolithic	0	0	8	100	8
Total	8	11	65	89	73

animals, approximately in equal proportions. Dog remains (but possibly also jackal) also indicate the presence predominately of adult animals, but the remains of animals younger than 4 months have also been recorded. The same

seems to hold true for foxes. The only cat mandible that could be assigned an age indicated an animal younger than 5–6 months. The rest of the species (*i.e.*, badger, hare, marten and hedgehog) are represented by adult

animals. Epiphyseal fusion data are not presented here because samples are as small as those of dental eruption and wear, and the results are similar. The only additional information is the presence of immature hedgehog remains

(e.g., unfused distal tibia). Overall, the results shown in Table 14.8 indicate that the majority of carnivores in the assemblage were adults. This is a rather expected result because most small- and medium-sized carnivores are fast-maturing animals. Nevertheless, the presence of immature animals is also confirmed.

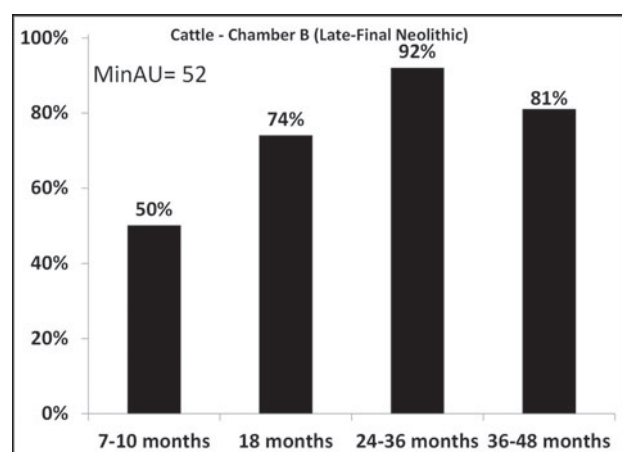


Figure 14.13. Mortality data for cattle based on epiphyseal fusion, Late-Final Neolithic period. Neonatal remains are excluded.

Male:female ratios

Sexed pelvises reveal a clear majority of females for sheep and goats (Table 14.9). Especially in the case of goats, the female majority is absolute, as no pelvis with male morphology has been recorded. Nevertheless, the presence of several particularly robust goat metapodia indicates that bucks were present at the site. The unfused state of most of those metapodia also suggests that bucks were slaughtered at a younger age than rams, thus significantly reducing the likelihood of being identified as males. Concerning sheep, male pelvises are absent from the Early and Late Neolithic samples, in contrast to later samples.

No cattle pelvis could be attributed to either male or female. The situation concerning pigs is only slightly

Table 14.8. Mortality data for rarer species based on dental eruption and wear

Species	Element	Eruption and wear	Age	Reference	Chamber – Period
Red deer	Mandible	M2 worn	>18 mths	Brown and Chapman	A – Early Neolithic
Red deer	Mandible	M3 lightly worn	50 mths	Brown and Chapman	B – Late Neolithic
Red deer	Mandible	dP4-M1 worn	18–27 mths	Brown and Chapman	B – Late/Final Neolithic
Red deer	Mandible	dP4 worn	5–27 mths	Brown and Chapman	D – Final Neolithic
Red deer	Mandibular tooth	M1/M2 heavily worn	>50 mths	Brown and Chapman	B – Final Neolithic
Red deer	Mandible	P3 lightly worn	>50 mths	Brown and Chapman	B – Final Neolithic
Dog?	Mandible	M1 worn	15–36 mths	Horard-Herbin 2000:	A – Early Neolithic
				stage ‘d’	
Dog/Jackal?	Mandible	M3 worn	>7 mths	Silver 1969	B – Late Neolithic
Dog	Mandibular teeth	P3/4 worn	>6 mths	Silver 1969	A – Final Neolithic
Dog	Mandible	dP3-4 unworn, M1 in crypt	<4 mths	Silver 1969	A – Early Neolithic
Dog/Jackal?	Mandible	M3 worn	>7 mths	Silver 1969	D – Final Neolithic
Dog	Mandible	M1-2 worn	>6 mths	Silver 1969	B – Final Neolithic
Dog	Mandible	M1 erupting	<4 mths	Silver 1969	D – Final Neolithic
Fox	Mandible	M1-2 lightly worn	Young adult		B – Late Neolithic
Fox	Mandible	M2 heavily worn	Old adult		B – Late Neolithic
Fox	Mandible	Permanent canine erupting	<17–18 weeks	Linhart 1968	B – Late/Final Neolithic
Fox	Mandible	Permanent dentition erupted	Adult		B – Final Neolithic
Fox	Mandible	M2-3 visible in crypt	<18–19 weeks	Linhart 1968	B – Final Neolithic
Cat	Mandible	M1 erupting	<5–6 mths	Silver 1969	B – Final Neolithic
Badger	Mandible	M1 and M2 lightly worn	Young adult	Lüps and Roper 1988	B – Final Neolithic
Hare	Mandible	Permanent dentition	Adult		B – Final Neolithic
Marten	Mandible	Permanent dentition lightly worn	Young adult		B – Late Neolithic
Hedgehog	Mandible	Permanent dentition	Adult		B – Late Neolithic
Hedgehog	Mandible	Permanent dentition	Adult		B – Late Neolithic
Hedgehog	Mandible	Permanent dentition	Adult		B – Early/Final Neolithic
Hedgehog	Mandible	Permanent dentition	Adult		B – Final Neolithic

Table 14.9. Male and female sexed pelves for sheep and goat

Chamber	Period	Taxon	Female (MinAU)	Male (MinAU)
A	Early Neolithic	Sheep	1	0
		Goat	2	0
		S/G combined	4	0
B	Late Neolithic	Sheep	8	0
		Goat	3	0
		S/G combined	14	0
B	Late/Final Neolithic	Sheep	0	0
		Goat	2	0
		S/G combined	2	1
B	Final Neolithic	Sheep	14	3
		Goat	7	0
		S/G combined	21	3
D	Final Neolithic	Sheep	5	2
		Goat	4	0
		S/G combined	9	2
Z	Early/Final Neolithic	Sheep	1	0
		Goat	1	0
		S/G combined	2	0
All chambers and periods combined		Sheep	31	5
		Goat	19	0
		S/G combined	55	6

better, with 16 mandibular canines recorded from all chambers and periods. The majority belonged to male pigs (10 male and 6 female).

Fragmentation

In general, the post-depositional fragmentation of the faunal material from Alepotrypa is low due to the stable cave environment. In most samples, more than 65% of breakage occurred in the past. Excluding specimens that were obviously fragmented during and after excavation as well as neonatal remains that were usually deposited whole, all long bones (*i.e.*, except phalanges, astragalus and calcaneus) of the three most common species have been analysed in terms of their fragmentation state (Table 14.10). Most samples are small, but do indicate that cattle long bones were more heavily processed than those of pig and sheep/goat. This is expected as the larger a bone is the higher the need to be divided into manageable pieces. Not only do cattle have the lowest percentages of whole specimens but also the highest of 'shaft splinters', both indicators of intense fragmentation. In most contexts, pig and sheep/goat are fragmented in a similar way, with relatively high percentages of whole specimens and significant numbers of the 'end&shaft' and 'shaft splinter' categories. The percentages of 'cylinders' are generally low, which suggests that scavengers had limited access to discarded bones. Moreover, the highest percentages of shaft splinters are recorded in the Early Neolithic sample, which might suggest a more intensive processing of carcasses during that period in comparison with later phases.

Taphonomy

In order to evaluate the taphonomic agents that affected the assemblage and to what extent, every recorded specimen (except loose teeth) has been inspected for signs of burning, carnivore (or pig) gnawing, rodent gnawing, ingestion and copper/bronze staining; absence of the above was also noted. Of these, rodent gnawing and copper/bronze staining were absent, while only one sheep/goat specimen and one hare specimen were ingested. Moreover, it should be borne in mind that only sheep/goat and pig are represented by large enough samples. With few exceptions per chamber and period, carnivore gnawing was the most common modification with percentages in the 10–20% range for the most common species (*i.e.*, cattle, sheep/goat and pig) in most samples (Figure 14.14). Another consistent pattern is a tendency for more gnawing on larger species (*i.e.*, cattle specimens are more gnawed than pig specimens and those in turn more gnawed than sheep/goat). In some of the large samples (*e.g.*, Final Neolithic Chamber B) this holds true for red deer remains, which exhibit gnawing marks to a similar or even higher degree than cattle. This tendency is to be rather expected, given the higher probability of the larger, more robust bones to survive gnawing rather than being completely destroyed in the process. Judging from their morphology and size, it is evident that most gnawing marks were caused by dogs and possibly pigs, but there is also evidence that smaller-sized carnivores (*e.g.*, young dog/fox or adult small carnivores such as stone martens) have also gnawed bones of small species such as hare. Despite their overall low numbers, the remains of wild species such as red deer, fox and hare in some contexts (especially the largest sample of Final Neolithic Chamber B) have been more frequently gnawed than those of domestic animals.

Burning marks are consistently below 10% and usually below 5%, if we exclude small samples or rare species within larger samples. Most of the burning marks recorded cover only part of the specimen and thus are indicative of roasting rather than burning after consumption. The vast majority of burning marks have been recorded on cattle, pig and sheep/goat remains with the rest of the species almost unaffected by burning. Burning marks have been occasionally recorded on dog and fox remains, but their location and extent are more compatible with their having been burnt after defleshing rather than during roasting with muscle tissue attached to the bone. No other species, including the relatively common red deer, has been recorded with burning marks.

Pathology

The quantification of pathological conditions on postcranial elements is not presented in detail because of their particularly low occurrence. With the frequency of pathological conditions consistently below 1% of MaxAU

Table 14.10. Frequencies of different fragmentation types for cattle, pig and sheep/goat (combined)

Species	Cattle		Pig		Sheep/goat		Total
Fragmentation	MaxAU	%MaxAU	MaxAU	%MaxAU	MaxAU	%MaxAU	
Chambers A and B (Early Neolithic)							
Whole/almost whole	0	0	8	36	18	21	52
End and shaft, end splinter, shaft and end splinter	2	50	5	23	34	40	45
Shaft splinter	2	50	7	32	29	34	38
Shaft cylinder	0	0	2	9	4	5	6
Total	4	100	22	100	85	100	141
Chamber B (Late Neolithic)							
Whole/almost whole	2	10	16	40	56	25	78
Endandshaft, end splinter, shaftandend splinter	11	55	18	45	84	37	122
Shaft splinter	7	35	2	5	43	19	53
Shaft cylinder	0	0	4	10	45	20	49
Total	20	100	40	100	228	100	302
Chamber B (Late/Final Neolithic)							
Whole/almost whole	0	0	30	73	69	29	101
Endandshaft, end splinter, shaftandend splinter	3	43	9	22	93	39	107
Shaft splinter	4	57	1	2	26	11	33
Shaft cylinder	0	0	1	2	49	21	50
Total	7	100	41	100	237	100	291
Chamber B (Final Neolithic)							
Whole/almost whole	2	17	77	47	290	40	381
Endandshaft, end splinter, shaftandend splinter	9	75	58	36	247	34	334
Shaft splinter	1	8	16	10	108	15	132
Shaft cylinder	0	0	12	7	87	12	104
Total	12	100	163	100	732	100	951
Chamber D (Final Neolithic)							
Whole/almost whole	0	0	12	32	102	46	118
Endandshaft, end splinter, shaftandend splinter	4	44	14	38	82	37	108
Shaft splinter	5	56	8	22	32	14	48
Shaft cylinder	0	0	3	8	8	4	13
Total	9	100	37	100	224	100	287
Chamber B (Early-Final Neolithic)							
Whole/almost whole	0	0	4	27	34	36	40
Endandshaft + end splinter + shaftandend splinter	3	75	5	33	20	21	33
Shaft splinter	1	25	4	27	15	16	20
Shaft cylinder	0	0	2	13	26	27	28
Total	4	100	15	100	95	100	121
Chamber Z (Early-Final Neolithic)							
Whole/almost whole			4	67	12	31	16
Endandshaft, end splinter, shaftandend splinter			2	33	16	41	18
Shaft splinter	Absent		0	0	9	23	9
Shaft cylinder			0	0	2	5	2
Total			6	100	39	100	45

for all species, it can be suggested that the health condition of the animals at Alepotrypa was good. Moreover, the overwhelming majority of the recorded pathological conditions involve exostoses, especially on elements of the lower leg such as phalanges, calcaneus and distal tibia.

Another indicator of health condition is the occurrence of Linear Enamel Hypoplasia (LEH) on permanent molars. This condition has been consistently recorded, for sheep/goat and pigs, wherever the entire enamel surface of a tooth was available for inspection. For sheep and goat, due to the larger number of loose teeth, and hence increased visibility from the crown to the enamel-root junction, LEH has been

recorded on maxillary (instead of mandibular) permanent molars. Maxillary permanent molars were only recorded concerning the presence of LEH and did not contribute to taxonomic quantification (MinAU or MaxAU) or the analysis of other categories of data. Loose upper first and second molars cannot be safely separated on morphological grounds and, hence, were recorded as 'M1/2'. Due to the relatively low number of loose maxillary molars with visible enamel surface, all chambers and periods have been combined to produce a, nevertheless, small sample. The inspection of 39 maxillary 'M1/2' revealed 12 with LEH (31%). Moreover, 4 out of 8 maxillary third molars

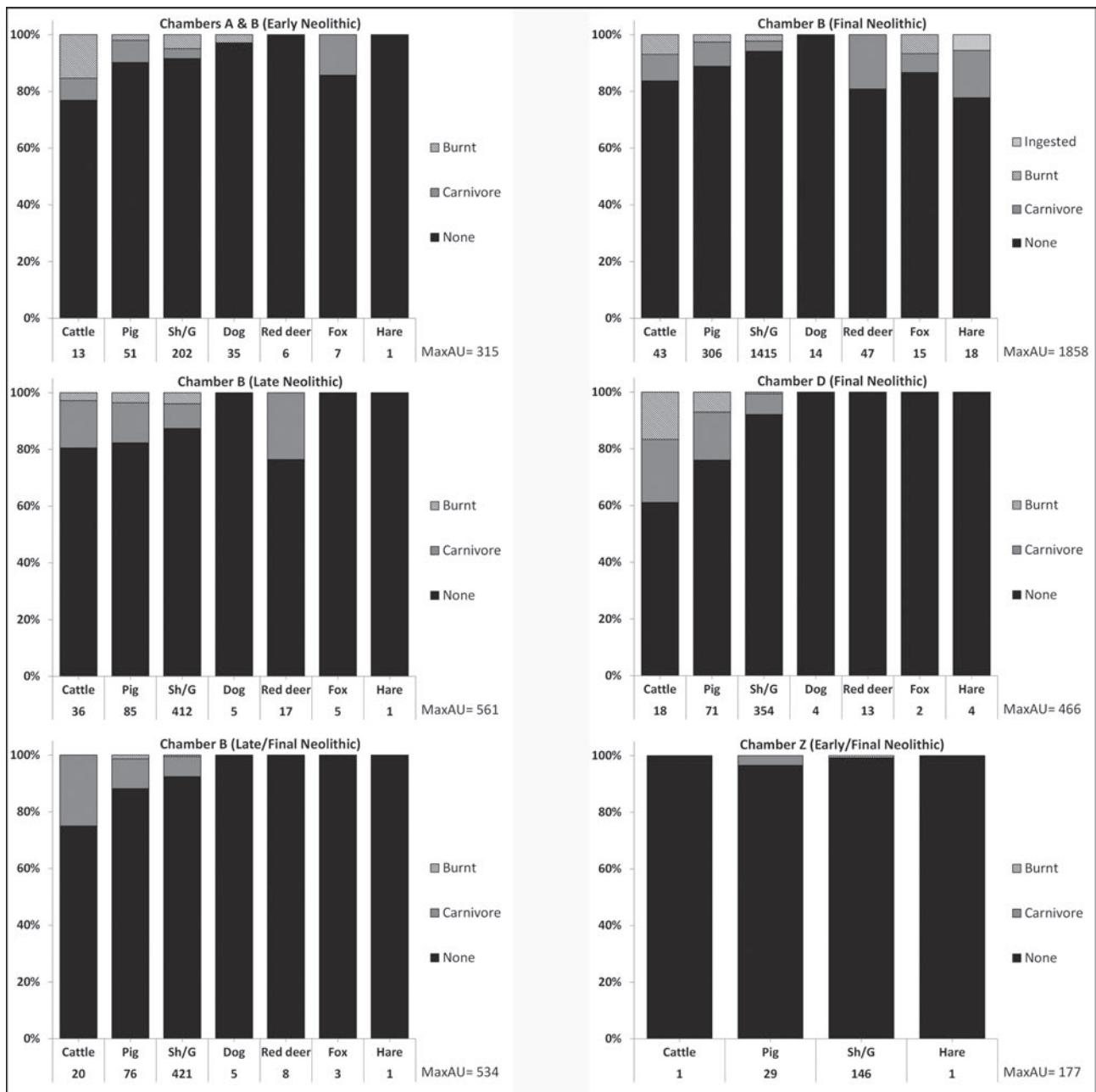


Figure 14.14. Incidence of taphonomic processes on mammal remains. 'Sh/G'= sheep/goat.

(50%) had LEH. Judging by few tentatively reconstructed rows of maxillary molars, the vast majority of LEH in the 'M1/2' category probably derives from second rather than first molars. The crown of mandibular second molars forms within the first year and, logically, the same holds true for maxillary second molars, which makes the LEH recorded on them more likely to have been caused by the hardships of the first winter rather than the first breeding season of the animals. The crown of mandibular third molars forms mostly within the second year (Milhaud and Nezeit 1991; Weinreb and Sharav 1964) and hence it is more likely that the LEH occurrence on that tooth is mostly due to the hardships of breeding.

The sample of pig mandibular molars that could be inspected for the presence or absence of LEH is also small, even with all chambers and contexts combined. LEH is infrequent on the first molar (1 out of 11 MinAU or 9%) and absent from the second molar (0 out of 7). Only three third molars could be inspected, one of which was recorded with LEH.

Butchery and bone tool making

The types of butchery recorded are: chopping, dismembering, filleting, skinning and percussion. Moreover, worked and sawn bones have also been recorded. The analysis

(Figure 14.15) showed that butchery marks are present on the remains of all mammal species, except the hedgehog. They are also present on species that are rare such as cat, marten, badger and ‘small carnivore’. Butchery marks are absent from bird and reptile remains.

Sheep/goat, pig, cattle and red deer, the most abundant species, exhibit percentages ranging from 25% to 50% for most chambers and periods. In most contexts, red deer remains appear to have been the most heavily butchered. Moreover, as in many other analyses, Chamber Z differs from the rest in that its sample produced lower percentages of butchery marks. The sample is rather small, but even the relatively abundant sheep/goat produced but

a low percentage. As far as carnivores (dog/jackal and fox) and hare are concerned, there is clear evidence of butchery on their remains, although their small numbers do not allow the identification of reliable chronological or spatial patterns. Another important aspect of butchery is that the majority of neonatal remains were butchered, which suggests a deliberate slaughter of neonatal animals, although it cannot be excluded that animals which died naturally were also butchered and consumed.

All specimens bearing butchery marks were further analysed to evaluate which types are the most common, thus providing information on carcass processing and consumption (Figure 14.16). On large- (cattle and red

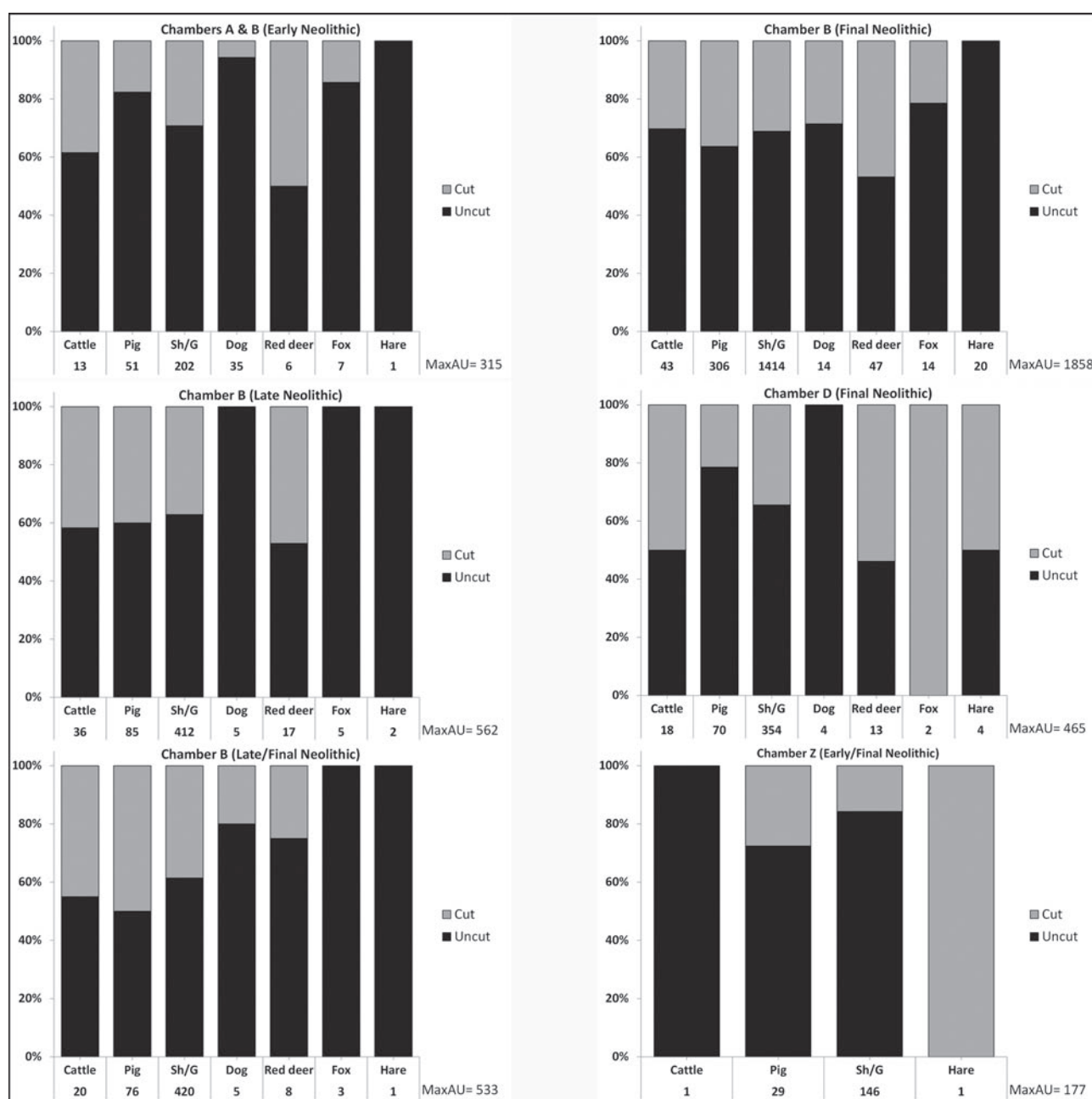


Figure 14.15. Incidence of butchery on mammal remains.

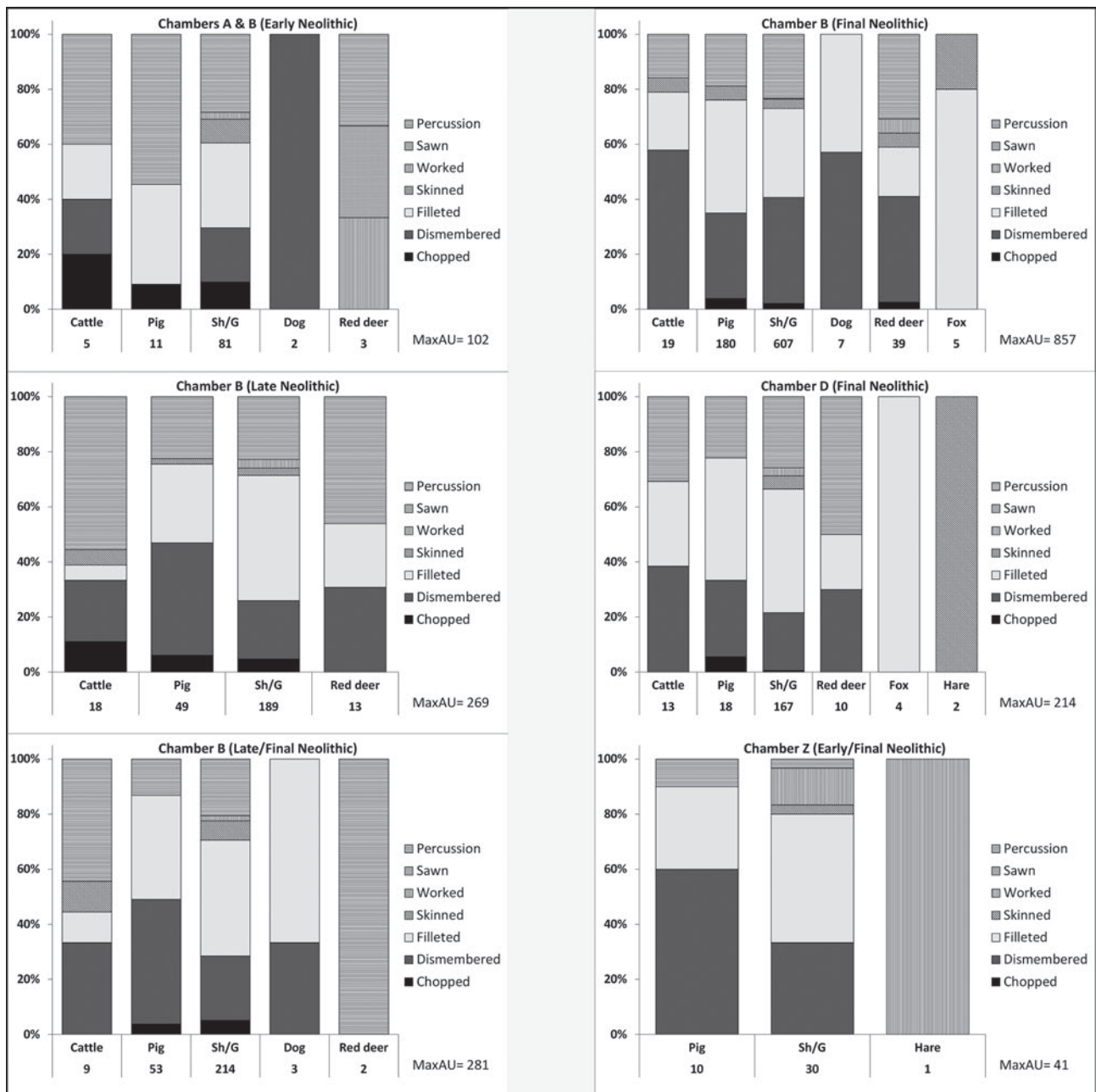


Figure 14.16. Frequencies of different types of butchery marks on mammal remains.

deer) and medium-sized (sheep/goat and pig) animals, the most common types are percussion, dismembering and filleting. Percussion may have been employed to dismember a body part, but it more commonly facilitated access to bone marrow, as the location of such marks in the middle of shafts suggests. The same purposes are also relevant concerning chopping. There is little chronological variation in the types of butchery recorded, with the exception perhaps of percussion and chopping marks being more common in Early, Late and Late/Final Neolithic than in Final Neolithic samples. Moreover, despite its limited reliability due to small sample size, Chamber Z differs from the rest in yet another aspect,

as it exhibits less percussion and no chopping marks. In terms of species, there are few differences between the most common domesticates (sheep/goat, pig and cattle), except for the tendency for more dismembering and filleting marks on pig remains for most contexts. Moreover, pig bones appear to be the least preferred for bone tools, in comparison to sheep/goat and red deer. Other noteworthy observations include the processing of dog carcasses exclusively through dismembering and filleting. Moreover, only filleting and skinning marks have been recorded on fox bones, while sawing was mainly recorded on red deer bones. Skinning marks are present on almost all species, and especially on small-sized

furry animals such as hare, marten, badger and fox. This indicates the processing and use of skins and pelts for clothing, among other possible uses. Overall, butchery at Alepotrypa included all aspects of carcass processing, from skinning to dismembering to filleting and even the production of tools and other objects made of bone. This can be used as additional evidence for the presence of live animals at the site, which were at some point slaughtered (or hunted nearby), processed and consumed.

Sheep/goat, red deer and hare bones appear to have been preferred for bone tool production. Sawn specimens (*e.g.*, CPII 36) were not recorded as ‘worked bone’, although they could be considered together, as sawing in most cases formed part of the process of bone tool manufacture rather than carcass processing. The number of worked bones is probably higher than that indicated by the graphs due to the absence of context information for many worked specimens. The most common types of worked bone are pointed tools of different types that indicate textile production and even the knitting of wool, assuming that sheep were of a woolly breed. The smallest type is made of thin bones such as sheep/goat ulna, probably used as needles. A larger type of point is usually made of distal metapodia and tibia of sheep/goat (*e.g.*, CPII 37) and red deer, as well as hare tibia. There are also few examples of red deer metapodia worked into longer points that are reminiscent of knitting needles (CPII 38), although that use cannot be confirmed nor refuted. Besides pointed tools, flat (spatula-like) tools were also produced

at Alepotrypa usually made from tibiae and ribs. A few pendants have been retrieved, including a fox canine tooth from Chamber Z (CP II 39).

Biometry

The analysis of biometric measurements is geared towards answering two specific questions. The first one is whether the wild pig is present. To address this question, distal humerus measurements from Alepotrypa have been plotted together with measurements from the slightly later (Early Helladic) site of Koropi-Medical Centre in Attica (Figure 14.17). The analysis shows that the majority of specimens form a cluster at the lower left of the graph. Moreover, there are two specimens from Alepotrypa plotting in the upper right part, with strikingly larger size than the rest. These specimens could represent wild pigs, although it cannot be entirely excluded that they represent male domestic pigs. Nevertheless, the size difference is so striking that the former scenario is the more likely. In addition, there are two specimens from Koropi that are of intermediate size and could represent male domestic pigs or female wild pigs. The inhabitants of Alepotrypa hunted red deer and wild carnivores such as cat and marten and hence it is quite probable that they also hunted wild pigs.

The second question revolves around the possibility of the presence of other canid species (*e.g.*, wolf and jackal) amongst the, clearly more abundant, domestic dog remains. Measurements from fully fused distal humeri

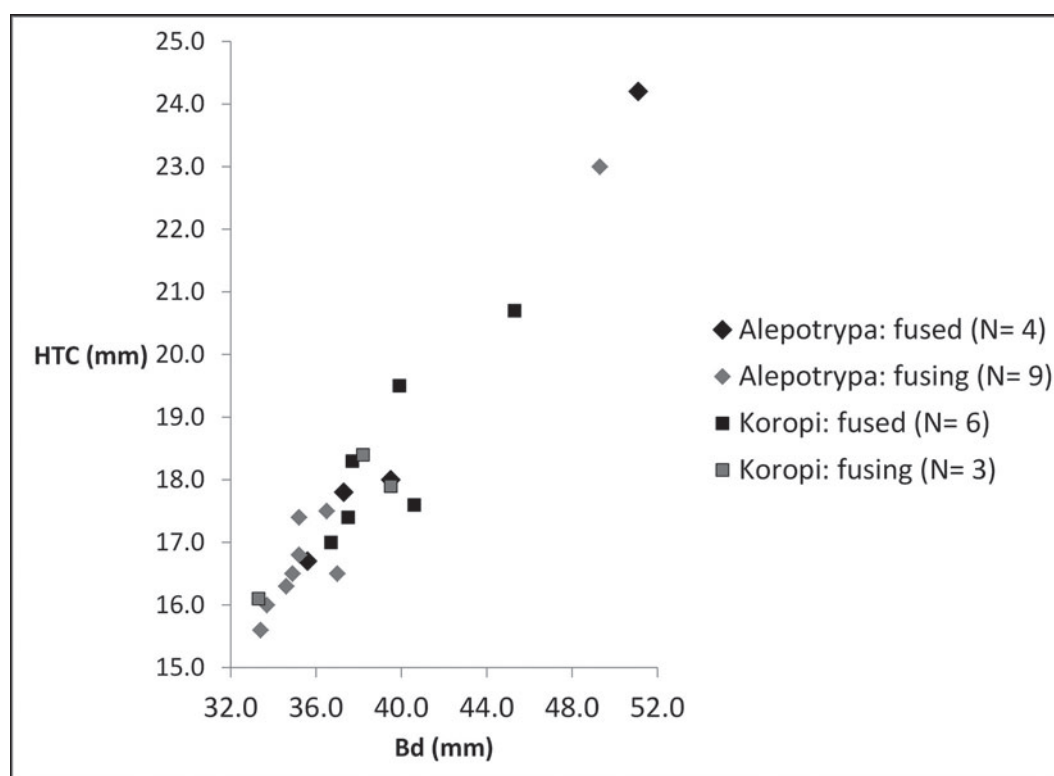


Figure 14.17. Scatterplot with measurements of pig distal humeri from Alepotrypa and Early Helladic Koropi Medical Center.

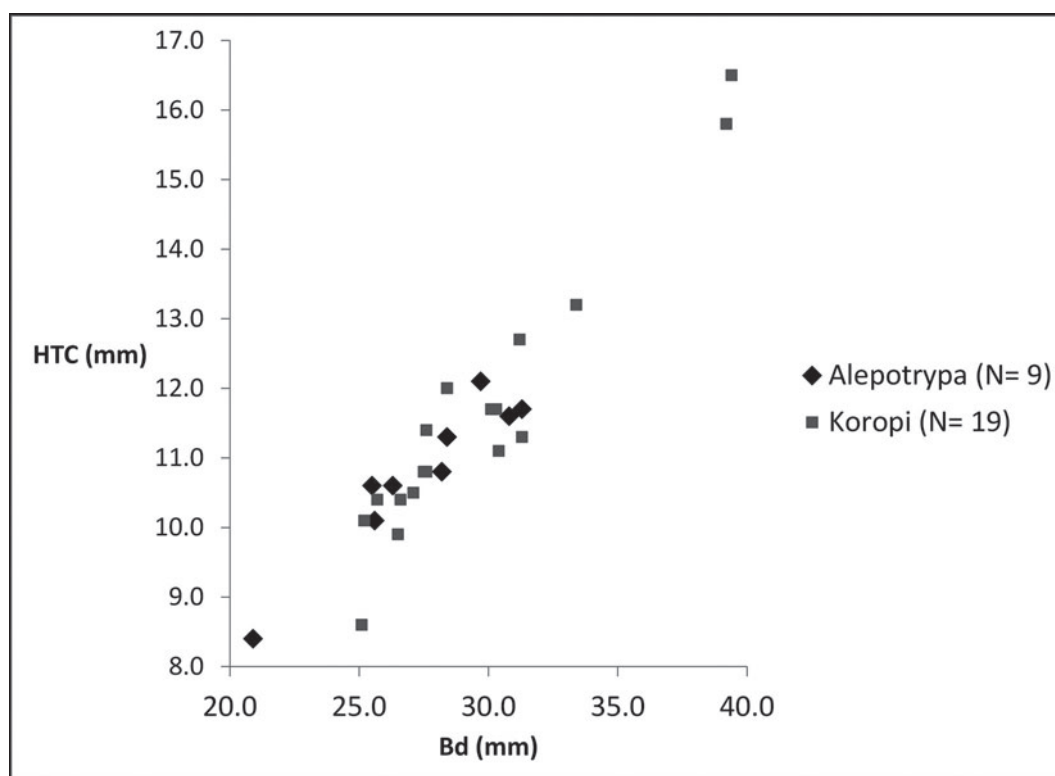


Figure 14.18. Scatterplot with measurements of dog distal humeri from Alepotrypa and Early Helladic Koropi Medical Centre. All plotted specimens are fully fused.

recorded as ‘dog’ or ‘canid’ were analysed and compared with those from Early Helladic Koropi (Figure 14.18). The pattern produced shows a large group in the middle of the plot, which most likely represents both male and female domestic dogs, as sexual dimorphism is not strong in this species. Moreover, the two particularly large specimens from Koropi represent wolves. The absence of specimens approaching that size from Alepotrypa indicates that wolves are either not present in the assemblage or that they were so rare in the wild that the possibility of their being represented in the assemblage is low. Furthermore, at the lower left of the scatterplot, there are two particularly small specimens, one from Alepotrypa and one from Koropi that could represent either a smaller species of canid such as the golden jackal (*Canis aureus*) or a smaller breed of dog. Fox is excluded as the size difference between foxes and dogs/jackals is significantly larger than the one observed in the scatterplot.

Discussion

Economy

Alepotrypa’s faunal assemblage provides valuable insights into the economic activities undertaken by the cave’s inhabitants from the Early to the Final Neolithic periods. The analyses show that the two main economic activities involving animals were animal husbandry and hunting. Animal husbandry was, by far, the more important of the

two as the overwhelming majority of domestic animals shows (Figures 14.1–7). Hunting was undoubtedly undertaken at Alepotrypa but played, at least economically, a marginal role as the low percentages of wild species suggest. In order to obtain a more complete picture of the economic activities of Alepotrypa’s inhabitants involving wild animals, fishing should also be considered (Theodoropoulou, this volume). Moreover, there might have been other, non-economic, interactions taking place at Alepotrypa between humans and some taxa such as birds (Tables 14.2–3), chelonians (Table 14.4), micromammals (Papayiannis, this volume) and molluscs (Theodoropoulou, this volume). For the bird and chelonian remains, which concern this chapter, the small samples hinder detailed interpretation. It is entirely possible that some bird species (*e.g.*, partridge), as well as marine turtle and land tortoise species, played an economic role, but their few remains and lack of evidence of butchery or consumption in general render this interpretation speculative. Nevertheless, their presence in the cave’s deposits also leaves open other possibilities, such as the use of turtle/tortoise shells as vessels, the use of tortoiseshell for the production of utilitarian objects (*e.g.*, combs) or ornaments and the use of birds in ritual practices.

Animal husbandry at Alepotrypa accounted for 90–95% of the faunal assemblage. Undoubtedly the most important species, economically, were sheep and goat.

Throughout the sequence (Early-Final Neolithic), sheep and goat were by far the most abundant taxon (accounting for 60–80% of mammal remains, depending on chamber/period) and clearly formed the basis of the domestic animal economy. Other relevant zooarchaeological studies show that this was the case for most Neolithic assemblages in central and southern Greece (*e.g.*, Halstead 1996, table 1, 28). Moreover, the analyses suggest a gradual increase in the importance of sheep and goat from the Early to the Late and Final Neolithic periods. Sheep versus goat percentages show that the former species was diachronically more abundant (Figures 14.1–7). As far as the management of sheep and goat herds is concerned, their age and sex structures provide some insights. Mortality in animals younger than one year old was particularly high, normally above 30% and exceeding 50% in some samples. Within the first year, significant mortality in animals younger than 6 months (including many neonatal) suggests that sheep and goat were milked. The presence of butchery marks on most neonatal remains provides further support to the scenario of deliberate slaughtering of neonatal and young animals, rather than natural deaths. Traditional cheese-making requires the slaughter of some animals before they are weaned to secure rennet for cheese production (Hadjikoumis 2017). Moreover, it is attractive to combine the evidence for the potential of milk production with the suitability of cave environments for the production, maturation and preservation of dairy products such as cheese. The heavy predominance of females in both adult sheep and goat is also compatible with a scenario of milk exploitation, although it should be borne in mind that mortality profiles also show additional peaks in older age intervals that reveal a concern with meat production too.

The production of wool and/or hair should also be considered, especially if we take into account additional lines of evidence in the form of bone tools (*e.g.*, CPII 37 and 38), some of which could have been used in processing wool or hair. Mortality and sex data do not support a particular focus on wool/hair, but it is possible that the older age-at-death of sheep and the presence of adult males in the Final, compared to the Early, Neolithic can be considered as tentative evidence for sheep wool/hair exploitation. Even without a particular focus on wool, the potential for the production of respectable quantities is there (Halstead and Isaakidou 2011a). It is particularly difficult to detect wool and hair exploitation based on the study of faunal remains alone but it is possible that woolly sheep, long-haired goats or both were present at Alepotrypa, at least in its Final Neolithic phase (*c.* 4,500–3,200 cal BC). Besides the potential for animal fibre exploitation, the use of sheep fleece and sheep/goat skins in general should also be added to the list of available raw materials of animal origin.

Despite their remains being frequently combined due to methodological and sample size constraints, sheep and

goat have different requirements and can be managed in different ways. Good knowledge of sheep and goat biology and behaviour by the herders of Alepotrypa would optimise their returns through fine-tuned adaptations of animal husbandry practices to local environments and socioeconomic needs. The analyses on sheep and goat remains provide indications for some differences between their respective management at Alepotrypa. To begin with, despite the overall stability of sheep to goat ratios throughout Alepotrypa's sequence, minor differences in their percentages in different contexts might indicate differences in management and eventually consumption and deposition. Moreover, the mortality profiles of sheep and goat reveal differences that may reflect management strategies that in turn are, at least partly, attributable to biological particularities of each species. For example, during the Late/Final Neolithic goat mortality peaked in the first year as well as at 2–3 years, while sheep mortality did so at 1–2 and 4–6 years. This pattern can be explained by differences in husbandry strategies and desired products from each species, but also as an effort to diversify and optimise returns. The higher mortality of goats in the first year can be explained by the tendency of this species to produce more offspring than sheep (*e.g.*, Payne 1973), to which the herders might have responded by slaughtering more kids than lambs to boost milk yields and/or improve the survival rate of remaining (predominately female) kids. The peaks at 1–2 years (and some at 2–3 years) for sheep and 2–3 years for goats could represent the age intervals during which most animals would reach optimum size for meat production, with sheep slaughtered at a younger average age due to faster growth rate. In addition to differences in growth rate, age-at-death might have also been influenced by possible differences in herding strategies. For example, it is possible that goat herds, if herded separately, were more mobile and had a diet of poorer quality, which would delay them from reaching the desired slaughter weight. Moreover, the documented practice in traditional Mediterranean animal husbandry of slaughtering bucks at 2–3 years, in contrast to keeping rams until older ages (Hadjikoumis 2017) could have also been practised at Alepotrypa, thus showing up in the data as increased mortality for goats compared to sheep. In turn, the higher survival of sheep to older age intervals (*e.g.*, 4–6 years) can be partly attributed to the same practice, but also to the possibility of wool exploitation, under the assumption that woolly sheep were present in Greece at least from the 4th millennium cal BC (Halstead and Isaakidou 2011a). Male and female numbers provide additional evidence for differences in the management of sheep and goat. A tendency for slaughtering almost all male goats at younger ages than sheep may have contributed to the absence of any positively identified adult male goat pelvis in the assemblage. To sum up, the analysis of caprine remains yielded evidence for the exploitation of both sheep and

goat for milk but also meat production, with tentative evidence for wool/hair exploitation. The particularly high percentages of sheep and goat combined paint a picture of a Neolithic animal economy, which revolved around the management of these two species. With the data at hand, it is suggested that Neolithic sheep and goat herders possessed a high level of expertise that enabled them to successfully manage animals for a variety of products over almost three millennia.

Economically, the second most important species at Alepotrypa was the pig, which constituted a secondary (to sheep/goat) source of meat for the cave's occupants with percentages consistently in the 15–20% range. Although wild pigs are probably present in the assemblage, the vast majority of suid remains belong to domestic pigs. Age-at-death data suggest that many pigs were slaughtered at optimal size (*i.e.*, 1–2 years), but even more, at ages younger than 12 months, including neonatal piglets. As in the case of kids and lambs, most neonatal remains had signs of butchery thus excluding natural death as the main cause of neonatal mortality. This pattern in pig mortality deviates from the optimal strategy for meat production but, nevertheless, constituted a sustainable pig husbandry system that remained fairly stable from *c.* 6,000 to 3,000 cal BC. The swine herders of Alepotrypa may have been slaughtering animals below optimal weight due to a seasonal concentration of large litters in combination with limited resources, such as labour and possibly space within the cave, all of which would be necessary to rear all piglets to higher weights. Another interpretation of the particularly high mortality in pigs younger than 6 months would be a seasonal occupation of the site, but other evidence (*e.g.*, sheep/goat mortality patterns and material culture) point towards constant use of the cave by humans, at least during most of the Neolithic. Alternatively, or concurrently, pig herders may have been responding to other stimuli such as social politics (Halstead 2012) and culinary preferences. Pig husbandry, though of lesser importance than sheep and goat husbandry, undoubtedly formed an integral part of Alepotrypa's animal economy throughout its Neolithic occupation.

Cattle numbers are consistently low in all chambers and periods. Given the limited availability of environments in the vicinity of the cave suitable for large cattle herds, their scarcity is not surprising. Overall, cattle played a marginal role in economic terms, although it should not be dismissed as insignificant. Their presence, albeit in small numbers, shows that cattle husbandry was part of the economic system of the site and provided beef and possibly milk, as the presence of neonatal and immature remains suggests. Moreover, the possibility of their use in agricultural work remains open. Assuming that the small cattle samples are reliable, they indicate some decrease in the importance of cattle from the Early and Late to the Final Neolithic, which corresponds with the increase of sheep and goat numbers.

Dog was also consistently present in all chambers and periods. The high percentage in Early Neolithic Chamber A might be related to ritual activity involving dogs, as increased numbers of dog remains were recovered in relation to an ossuary. Moreover, the presence of butchery marks on dog remains raises the possibility of occasional consumption. The meaning of this practice or whether it was widespread in the Early Neolithic cannot be clarified with the data at hand, but it would not be surprising (Hadjikoumis 2016). In the rest of the chambers, dog percentages are around 1% and the most parsimonious interpretation is that the domestic dog's main role was to assist humans in herding and guarding the livestock, especially sheep and goat. Moreover, the presence of wild species raises the possibility of dogs participating in hunting activities. The presence of remains of dogs younger than 4 months, both in Early and Final Neolithic samples (Table 14.8), suggests that dogs were bred at the site. Biometric analysis (Figure 14.18) suggests that wolves were absent or rare, but a smaller-sized canid was present in small numbers. Those remains more likely belong to the golden jackal, although a smaller type of domestic dog cannot be excluded. Wild canids such as wolves and jackals, if present, would be hunted or kept at bay by the herders and their dogs.

Wild animals were scarce overall, with combined percentages consistently below 8% and, in most samples, around 5% (*cf.* Halstead and Isaakidou 2013). Red deer was, both in absolute numbers and in meat weight, the most important wild species throughout the sequence. Its overall low numbers suggest that red deer was only occasionally and opportunistically hunted, perhaps involving only those animals tempted by cultivation near the site or herders coming across red deer while supervising their animals away from the site. The scarce age-at-death data suggest that both adult and immature red deer were hunted. The scarcity of remains of young animals, if not a product of the small sample sizes, might indicate their deliberate avoidance by hunters to ensure sustainability of the population, or alternatively consumption of such animals away from the site. Beyond meat, the inhabitants of Alepotrypa also used red deer antlers and bone for the manufacture of a wide range of tools.

Besides red deer, several other mammal species were hunted and consumed. The hare apart, all the rest were carnivores (fox, cat, marten, badger, and possibly jackal and another small carnivore or mustelid). The presence of the hedgehog in Final Neolithic contexts is confirmed, but there is no means to determine whether this species was consumed by humans at Alepotrypa. Fox, hare and badger are present in samples of all periods and the presence of butchery marks on their remains confirms that humans hunted and processed these animals for the double purpose of consuming their meat and utilising their pelts. The same can be said about the marten, which was present only in Final Neolithic samples. Hare bone appears to have been

a preferred raw material for bone tools, possibly because of its suitability in terms of size and density depending on the purpose for which it would be used. Concerning the fox, and possibly also the jackal, the protection of lambs, kids and piglets is another reason for humans to hunt them and discourage their approach to the cave.

The case of cat remains is intriguing because it is unknown whether they belonged to a wild or tamed/domestic animal. Butchery marks on some of its bones can be viewed, especially from a modern mindset, as evidence for cat being yet another hunted wild carnivore, as mustelids and canids were. With the available knowledge on cat domestication in the eastern Mediterranean (*e.g.*, Faure and Kitchener 2009), a wild status for the cat remains at Final Neolithic Alepotrypa is the most likely scenario; but the issue of when exactly domestic cats appeared in Greece remains open and should be addressed in future studies.

Beyond mammals, the presence of several species of bird (Tables 14.2–3) is noteworthy. Some of the bird species possibly lived in or around the cave (*e.g.*, corvids, owls, pigeons and birds of prey), while others may have been captured and consumed by humans (*e.g.*, crane and partridge). It is also possible that during the entire Neolithic period, land tortoises and/or marine turtles were also consumed, although unambiguous evidence for the practice is absent. It is also plausible that humans simply collected empty shells for other uses (*e.g.*, as vessels or ‘boxes’), judging from the exclusive presence of carapace and plastron parts in the assemblage (Table 14.4).

Seasonality

The large numbers of neonatal (some possibly foetal) and immature sheep and goats illustrate a seasonal intensification of animal-related activities at Alepotrypa. Age-at-death data do not support an exclusively seasonal occupation of the cave, as animals of all ages are present. Nevertheless, a seasonal increase in people (and animals) and in the intensity of the cave’s use during and following the birth season is plausible. Assuming a broad similarity between Neolithic and ethnographically documented husbandry practices from relevant environmental settings (*e.g.*, Hadjikoumis 2017; Halstead 1998; Halstead and Isaakidou 2011b), it is reasonable to suggest that the busiest period, in terms of pastoral activities, was between early winter and late summer. Besides sheep, goat, pig and cattle births, that busy part of the year most probably included the selection of neonatal and immature animals (predominately males) to be slaughtered, the selection of females and males for herd replacement, the milking and production of dairy products and possibly the harvest of wool and/or hair from sheep/goat.

Spring and summer in Greece is warm. Milk or dairy products left exposed to temperature fluctuations quickly spoil. It is, thus, reasonable to assume that the

availability of a cool and stable cave environment would have promoted milking and dairying, in contrast to open-air Neolithic sites in Greece, which typically lack any evidence for milking (*e.g.*, Halstead 1998). Besides dairy products, the accumulation of animal and plant fibres during the summer would be followed by their processing and the manufacture of fabrics during autumn and winter. In order to envisage a complete picture of the activities undertaken by the cave’s occupants on a seasonal basis, as well as the interplay between them in terms of labour and mutually beneficial practices (*e.g.*, stubble available for grazing sheep), the integration of zooarchaeological with archaeobotanical data is necessary.

Chamber Z

Chamber Z failed to yield any precise radiocarbon dates, a fact which has forced the site’s excavators to consider it as chronologically belonging anywhere between the Early and Final Neolithic. In addition, Chamber Z presented a number of particularities when compared to any other chamber. These include the presence of whole but intentionally broken ceramic vessels, a fill with a black matrix reminiscent of manure and the absence of substantial architectural remains. The contextual particularity of Chamber Z is also reflected in its faunal sample, although no striking differences have been noted in terms of species composition and age-at-death. It differs from other chambers in its near-absence of cattle, stronger predominance of sheep/goat (and sheep within this taxon), the lower overall species diversity (also attributable to the small size of the sample) and little evidence of gnawing and burning. Its faunal composition is more reminiscent of other samples of the Final Neolithic (*e.g.*, Chambers B and D). This similarity can be viewed as evidence for a Final rather than an Early Neolithic chronology of the faunal sample from Chamber Z. The position of Chamber Z deeper in the cave and near a precipitous drop before the innermost chamber containing the lake may have played a role in the human choice of using that chamber in a different way.

Environment

The study of macromammals can only provide general insights into the environments exploited by the cave’s inhabitants during the Neolithic. Nevertheless, in a previously little studied environmental setting, any information on the subject is valuable. The main characteristic of the assemblage is the strong majority of sheep and goat through time, which is a constant all over Greece during the Neolithic. The extent of this majority, however, might be indicative of the capacity of local environments to support either sheep and goat, or other species (such as pig and cattle) with different requirements. In the case of Alepotrypa, sheep and

goat account for 60–80% of each sample, which is not unique but is among the highest for mainland Greece (*e.g.*, Halstead 1996, table 1, 28). Usually only island assemblages exhibit percentages above 70–80%, although in contrast to them, Alepotrypa shows a clear majority of sheep, thus being in accordance with most mainland assemblages in that respect. Moreover, at Alepotrypa there is an increase in sheep/goat numbers through time, culminating in percentages around 75% in the Late and Final Neolithic phases. The central role of sheep/goat and the particularly low cattle and wild animal percentages are compatible with shrub and low grassy vegetation rather than dense forest. Indeed the environment around the cave today is rocky with but a few precious pockets of thicker soil. It cannot support any extensive forest or extensive cultivations close by, although there are some exceptions at a greater distance from the site. If the Neolithic environmental setting was even broadly similar to that of today, then the particularly high sheep/goat percentages could be, at least partly, attributed to the rocky and largely barren landscape. Such high percentages have only been documented at cave or island environments, or both (Halstead 1996, table 1, 28–29), perhaps due to similarities in the landscape and vegetation at those sites. The increase in sheep/goat percentages at Alepotrypa from the Early to the Late and Final Neolithic might indicate a gradual further reduction of forested areas through time, either due to human interference or naturally occurring aridification.

Some species present in the assemblage such as cattle, red deer, marten, tortoise and woodpigeon (if present, instead of rock pigeon) thrive, to varying degrees, in or around reasonably forested habitats. Their presence indicates some availability of such habitats in the area, although their small numbers suggest forested environments either a long distance away or of a limited extent. Another type of habitat around the cave is the abrupt and rocky coastline with the exception of a few beaches. The nearest beach to Alepotrypa is only a few meters below the cave's entrance and although it currently consists mainly of large pebbles, in the recent, and possibly the distant, past it was sandy. In terms of fauna, rocky cliffs are ideal habitats for birds (*e.g.*, gulls, crows, rock pigeons) and sandy beaches are suitable for turtle nesting. Some of these resources may have been exploited directly by humans or indirectly through the hunting of predators (*e.g.*, fox, cat, marten) attracted to them.

Consumption

Sheep, goat and cattle provided the inhabitants of Alepotrypa with meat, as well as their milk or dairy products from c. 6000 to 3000 cal BC. Pork was also regularly consumed and possibly pig fat was also used in the diet or to preserve meat. A lot of the meat consumed from the four main domestic species was tender as the

high percentages of immature animals suggest. It is unknown whether milk was consumed raw or processed into dairy products, or both. Whatever the case, it is almost certain that milk, one way or another, featured in the diet of the cave's inhabitants. The large numbers of immature animals slaughtered indicate that there would have been periods of increased availability of meat and dairy products during the year. This raises questions concerning the mechanisms developed to absorb increased availability (Halstead 2004), but the data at hand cannot point definitively in any specific direction. The most likely explanations are: (i) temporarily increased meat consumption through feasting, possibly undertaken by a seasonally increased population assembling for economic and/or sociocultural reasons, and (ii) the exchange of dairy products with other human groups in the area specialising in other economic activities (*e.g.*, agricultural produce).

Occasionally, dog, red deer, hare, badger, marten, cat and possibly wild boar and jackal meat was also consumed. No butchery was noted on bird and chelonian remains, but some of the identified taxa might have been consumed. Overall, a broad diversity of species was consumed but, in terms of absolute quantities and frequency, the bulk of animal protein consumed derived almost exclusively from sheep, goat, pig and cattle. Significant numbers of fish were also captured and should be added to the Neolithic 'menu' at Alepotrypa (Theodoropoulou, this volume).

The anatomical representation (Appendix 14.1) and types of butchery marks recorded on the remains of the most common species (Figure 14.16) show that entire carcasses were processed at the site. All stages of carcass dressing are present and in relatively balanced proportions. The inhabitants of Alepotrypa divided animal carcasses into smaller portions (including filleting), which is more compatible with cooking in pots and ovens or pits than with roasting entire animals on open fire. Dismembering and filleting marks were common also on neonatal remains and suggest that even small-sized carcasses were further divided prior to cooking. Another indication for culinary practices involving cooking in pots and ovens or pits, rather than open fires, is the low occurrence of burning (Figure 14.14). Fragmentation patterns (Table 14.10) suggest that access to marrow was facilitated through fracturing long bone shafts whilst fresh, although not to an intensive degree. This can be read as an indication of stability in availability of animal protein, which reduced the need for intensive fragmentation to make the most out of the calories available.

Conclusions

The size and preservation condition of the macrofaunal assemblage of Alepotrypa has allowed a wide range of analyses, the interpretation of which sheds new light onto several aspects of the human–animal relationship in Neolithic Greece. The overall picture of Alepotrypa is

that of a distinctive site that contributes new knowledge on Neolithic animal husbandry and human–animal interactions in general. Although not to a degree that would make it quite out of the ordinary, the site does present several particular characteristics.

In the chronological periods covered by the samples under study (Early-Final Neolithic), there was no dramatic change in either the nature or the intensity of human–animal interactions. The faunal composition of the assemblage is typical of Neolithic Greece, although species frequencies are more characteristic of cave and island sites in containing high sheep/goat percentages, especially by Late and Final Neolithic standards. This is attributable to the site's type (*i.e.*, a cave) and the surrounding environment. The analyses paint a picture of diversity concerning the animal husbandry strategies. In contrast to most open-air sites, Alepotrypa yielded, besides meat production, strong evidence of milk as well as reasonable evidence of wool/hair exploitation, even from the earliest phases (*i.e.*, c. 6,000 cal BC). Besides sheep and goat, evidence of milking also exists for cattle. Pig played a secondary role, compared to sheep/goat, but was important nevertheless in providing significant quantities of meat. Cattle, perhaps due to the largely unsuitable dry and rocky environment, played a largely marginal economic role in comparison to sheep/goat and pig, but their presence added further diversity and security to Alepotrypa's economic system. Although the Early Neolithic samples are small, their comparison with those of Late/Final Neolithic chronology suggests an increase in the importance of sheep and goat at the expense of cattle, pig and wild animals. This evidence supports a scenario of some intensification and specialisation towards sheep/goat husbandry, especially if combined with clearer evidence of milking and wool/hair exploitation in the later phases. Wild animals played additional and largely unknown roles in the sociocultural sphere, but the hard evidence indicates that their contribution in terms of meat was modest. Nevertheless, many of the hunted species also contributed their pelts/skins (*e.g.*, red deer, fox, hare, marten and cat) or raw material for bone tools (*e.g.*, red deer bone/antler and hare bone). Interactions with bird and chelonian species were also quite limited and the possibility of their consumption, as well as the use of their body parts in other activities, remains open.

The analysis of the assemblage indicates that the yearly cycle of pastoral activities was uneven, with a period of intense activity, roughly from early winter until late summer that included births, slaughter of young males and unwanted females, milking, production of dairy products and possibly the harvesting of wool/hair. This seasonally increased demand for labour, combined with the concomitant increased availability of meat and milk, constitute strong incentives for a seasonal congregation of more people at Alepotrypa. The exact reasons and context of such seasonal activities cannot be clarified only based

on faunal remains. Nevertheless, it can be speculated that this potential for seasonal consumption of animal protein by relatively larger human groups was fulfilled, independently of the specific context in which it took place (*e.g.*, religious, social, economic, or a combination of those).

The environmental setting around Alepotrypa during its Neolithic occupation must have been almost as rocky and barren as that of today, although there are indications through the faunal composition for some differences, such as more forest coverage and sandier coves. There is also tentative evidence for either increased aridity or reduced forest coverage, or both, towards the end of the Neolithic period, reflected in a decrease in forest-loving species in favour of sheep and goat.

Chamber Z, in terms of its faunal sample, is more compatible with a Final Neolithic chronology. In general, almost all types of data indicate differences between Chamber Z and the rest of the chambers, although the small sample involved cannot provide any further details as to the causes.

Entire animal carcasses were processed and consumed at Alepotrypa throughout its occupation sequence. There is evidence for skinning, dismembering and filleting for almost all identified species, except for the hedgehog, birds and chelonians, which could have also been consumed. The Neolithic animal 'menu' was dominated by sheep, goat and pig with a marginal presence of cattle, as well as the occasional consumption of hunted species such as red deer, wild pig, hare and wild carnivores (fox, badger, marten, cat and possibly jackal). Cooking of meat was primarily done in pots, ovens or pits and less so on an open fire.

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Bibliography

- Albarella, U. and Payne, S. (2005) Neolithic pigs from Durrington Walls, Wiltshire, England: a biometrical database. *Journal of Archaeological Science* 32, 589–599.
- Balasse, M. and Ambrose, S. H. (2005) Distinguishing sheep and goats using dental morphology and stable carbon isotopes in C4 grassland environments. *Journal of Archaeological Science* 32, 691–702.
- Barone, R. (1976) *Anatomie comparée des mammifères domestiques*. Paris.
- Bocheński, Z. M. and Tomek, T. (2009) *A Key for the Identification of Domestic Bird Bones in Europe: Preliminary Determination*. Kraków.
- Boessneck, J., Müller, H.-H. and Teichert, M. (1964) Osteologische unterscheidungsmerkmale zwischen Schaf (*Ovis aries* Linné) und Zeige (*Capra hircus* Linné). *Kühn-Archiv* 78, 1–129.
- Brown, W. A. B. and Chapman, N. G. (1991) The dentition of red deer (*Cervus elaphus*): a scoring system to assess age from wear of the permanent molariform teeth. *Journal of Zoology* 224, 519–536.
- Bull, G. and Payne, S. (1982) Tooth eruption and epiphyseal fusion in pigs and wild boar. In B. Wilson, C. Grigson and S. Payne (eds), *Ageing and Sexing Animal Bones from Archaeological Sites*, 55–71. (British Archaeological Report 109). Oxford.
- Cohen, A. and Serjeantson, D. (1996) *A Manual for the Identification of Bird Bones from Archaeological Sites* (2nd edn.). London.
- Davis, S. J. M. (1996) Measurements of a group of adult female Shetland sheep skeletons from a single flock: a baseline for zooarchaeologists. *Journal of Archaeological Science* 23, 593–612.
- Faure, E. and Kitchener, A. C. (2009) An archaeological and historical review of the relationships between felids and people. *Anthrozoös* 22, 221–238.
- Grant, A. (1982) The use of tooth wear as a guide to the age of domestic ungulates. In B. Wilson, C. Grigson and S. Payne (eds), *Ageing and Sexing Animal Bones from Archaeological Sites*, 91–108. (British Archaeological Report 109). Oxford.
- Grigson, C. (1982) Sex and age determination of some bones and teeth of domestic cattle: a review of the literature. In B. Wilson, C. Grigson and S. Payne (eds), *Ageing and Sexing Animal Bones from Archaeological Sites*, 7–23. (British Archaeological Report 109). Oxford.
- Hadjikoumis, A. (2016) Every dog has its day: first glimpses into everyday life in Early Bronze Age Attica. In N. Marom, R. Yeshurun, L. Weissbrod and G. Bar-Oz (eds) *Bones and Identity: Zooarchaeological Approaches to Reconstructing Social and Cultural Landscapes in Southwest Asia*, 225–245. Oxford.
- Hadjikoumis, A. (2017) Age-at-death in Cypriot traditional sheep and goat husbandry: the implications for zooarchaeology. In P. Rowley-Conwy, D. Serjeantson, and P. Halstead (eds), *Economic Zooarchaeology*, 126–134. Oxford.
- Halstead, P. (1985) A study of mandibular teeth from Romano-British contexts at Maxey. In F. Pryor, C. French, D. Crowther, D. Gurney, G. Simpson and M. Taylor (eds), *The Fenland Project: Archaeology and Environment in the Lower Welland Valley, volume 1*, 219–224. (East Anglian Archaeology 27). Cambridge.
- Halstead, P. (1996) Pastoralism or household herding? Problems of scale and specialization in early Greek animal husbandry. *World Archaeology* 28, 20–42.
- Halstead, P. (1998) Mortality models and milking: problems of uniformitarianism, optimality and equifinality reconsidered. *Anthropozoologica* 27, 3–20.
- Halstead, P. (2004) Farming and feasting in the Neolithic of Greece: the ecological context of fighting with food. *Documenta Praehistorica* 31, 151–161.
- Halstead, P. (2011) Faunal remains from FN-EH Nemea Tsoungiza: husbandry, butchery, consumption and discard of animals. In D. J. Pullen (ed.), *Nemea Valley Archaeological Project I: The Early Bronze Age Village on Tsoungiza Hill*, 741–800. Princeton.
- Halstead, P. (2012) Feast, food and fodder in Neolithic-Bronze Age Greece: commensality and the construction of value. In S. Pollock (ed.) *Between Feasts and Daily Meals. Towards an Archaeology of Commensal Spaces*, 21–51. (eTopoi, Journal for Ancient Studies, Special Volume 2). Berlin.
- Halstead, P. and Isaakidou, V. (2011a) Revolutionary secondary products: the development and significance of milking, animal-traction and wool-gathering in later prehistoric Europe and the Near East. In T. Wilkinson, S. Sherratt and J. Bennet (eds), *Interweaving Worlds: Systemic Interactions in Eurasia, 7th to 1st Millennia BC*, 61–76. Oxford.
- Halstead, P. and Isaakidou, V. (2011b) A pig fed by hand is worth two in the bush: ethnoarchaeology of pig husbandry in Greece and its archaeological implications. In U. Albarella and A. Trentacoste (eds), *Ethnozooarchaeology: the Present and Past of Human-Animal Relationships*, 160–174. Oxford.
- Halstead, P. and Isaakidou, V. (2013) Early stock-keeping in Greece. In S. Colledge, J. Connolly, K. Dobney and S. Shennan, S. (eds), *The Origins and Spread of Stock-keeping in the Near East and Europe*, 129–144. Walnut Creek.
- Halstead, P., Collins, P. and Isaakidou, V. (2002) Sorting the sheep from the goats: morphological distinctions between the mandibles and mandibular teeth of adult *Ovis* and *Capra*. *Journal of Archaeological Science* 29, 545–553.
- Horard-Herbin, M.-P. (2000) Dog management and use in the late Iron Age: the evidence from the Gallic site of Levroux (France). In S. J. Crockford (ed.), *Dogs Through Time: An Archaeological Perspective. Proceedings of the 1st ICAZ Symposium on the History of the Domestic Dog. Eighth Congress of the International Council for Archaeozoology 1998*. Victoria, B.C., Canada, 115–137. (British Archaeological Report S889). Oxford.
- Kratochvil, Z. (1969) Species criteria on the distal section of the tibia in *Ovis* Ammon F. Aries L. and *Capra* Aegagrus F. Hircus L. *Acta Veterinaria*, 38, 483–490.
- Linhart, S. B. (1968) Dentition and pelage in the juvenile red fox (*Vulpes vulpes*). *Journal of Mammalogy* 49, 526–528.
- Lüps, P. and Roper, T. J. (1988) Tooth size in the European badger (*Meles meles*) with special reference to sexual dimorphism, diet and intraspecific aggression. *Acta Theriologica* 33, 21–33.

- Mayer, J. J. and Brisbin, L. I. Jnr. (1988) Sex identification of *Sus scrofa* based on canine morphology. *Journal of Mammalogy*, 69, 408–412.
- Milhaud, G. and Nézit, J. (1991) Développement des molaires chez le mouton, étude morphologique, radiographique et microdurométrie. *Recueil de Médecine Vétérinaire* 167, 121–127.
- Pales, L. and Garcia, M. (1981) *Atlas ostéologique pour servir à l'identification des mammifères du Quaternaire*. Paris.
- Payne, S. (1969) A metrical distinction between sheep and goat metacarpals. In P. J. Ucko and G. W. Dimbleby (eds), *The Domestication and Exploitation of Plants and Animals*, 295–305. London.
- Payne, S. (1972) Partial recovery and sample bias: the results of some sieving experiments. In E. S. Higgs (ed.), *Papers in Economic Prehistory*, 49–64. Cambridge.
- Payne, S. (1973) Kill-off patterns in sheep and goats: the mandibles from Aşvan Kale. *Anatolian Studies* 23, 281–303.
- Payne, S. (1985) Morphological distinctions between the mandibular teeth of young sheep, *Ovis*, and goats, *Capra*. *Journal of Archaeological Science*, 12, 139–147.
- Payne, S. (1987) Reference codes for wear states in the mandibular cheek teeth of sheep and goats. *Journal of Archaeological Science* 14, 609–614.
- Payne, S. and Bull, G. (1988) Components of variation in measurements of pig bones and teeth, and the use of measurements to distinguish wild from domestic pig remains. *Archaeozoologia* 2, 27–66.
- Prummel, W. and Frisch, H.-J. (1986) A guide for the distinction of species, sex and body side in bones of sheep and goat. *Journal of Archaeological Science*, 13, 567–577.
- Schmid, E. (1972) *Atlas of Animal Bones*. New York.
- Von den Driesch, A. (1976) *A Guide to the Measurement of Animal Bones from Archaeological Sites*. Cambridge, MA.
- Weinreb, M. M. and Sharav, D. M. D. (1964) Tooth development in sheep. *American Journal of Veterinary Research* 25, 891–908.
- Zeder, M. A. and Lapham, H. A. (2010) Assessing the reliability criteria used to identify postcranial bones in sheep, *Ovis*, and goats, *Capra*. *Journal of Archaeological Science*, 37, 2887–2905.

Appendix 14.1. Raw data of Minimum number of Anatomical Units (MinAU) per chamber. Maximum number of Anatomical Units (MaxAU) is indicated in parenthesis if different from MinAU. P = proximal half, D = distal half

Chamber A (Early Neolithic)

Anat. unit Taxon	Cattle	Pig	Sheep/ Goat	Sheep	Goat	Dog	Red deer	Fox	Hare	Badger	Small carnivore	Total
Horncore/Antler	1 (2)	N/A	0	1	3 (4)	N/A	1	N/A	N/A	N/A	N/A	6 (8)
Mandible/loose teeth	5	9 (13)	2 (3)	1	6	3	0	1	0	1	0	28 (33)
Atlas	0	0	5 (7)	0	0	2	0	0	0	0	0	7 (9)
Axis	0	0	2	0	0	0	0	0	0	0	0	2
Scapula	2	4	11 (12)	1	5	2	0	0	0	0	0	25 (26)
Humerus P	0	4	5 (6)	0	0	3	0	0	0	0	0	12 (13)
Humerus D	0	3	6	0	1	4	1	0	0	0	0	15
Radius P	0	1	6	2	2	1	1	0	0	0	1	14
Ulna	1	0	6	0	1	2	0	0	0	0	0	10
Radius D	0	1	6	1	0	2	1	0	0	0	1	12
Metacarpus P	0	1	4	5	1	3	1	0	0	0	0	15
Metacarpus D	0	0	4	5	3 (4)	3	0	0	0	0	0	15 (16)
Pelvis	0	4 (6)	7 (10)	1	4	0	0	0	1	0	0	17 (22)
Femur P	1	5	7 (9)	1	0	1	0	0	0	0	0	15 (17)
Femur D	2	5	3 (5)	0	1	1	0	0	0	0	0	12 (14)
Tibia P	1	4	8 (10)	1 (2)	0	0	0	0	0	0	0	14 (17)
Tibia D	0	3	2 (7)	5	0	0	0	0	0	0	0	10 (15)
Astragalus	0	0	0	0	1	0	0	0	0	0	0	1
Calcaneus	0	0	1	1	0	1	0	0	0	0	0	3
Metatarsus P	0	1	3 (6)	5	2	3	0	3	0	0	0	17 (20)
Metatarsus D	0	1	5 (6)	3	2	3	0	3	0	0	0	17 (18)
1st Phalanx	1	3	1	3	1	1	0	0	0	0	0	10
2nd Phalanx	0	0	0	2	0	0	0	0	0	0	0	2
3rd Phalanx	0	0	0	1	1	0	0	0	0	0	0	2
Total	14 (15)	49 (55)	94 (117)	39 (40)	34 (36)	35	5	7	1	1	2	281 (314)

Chamber B (Early Neolithic)

Anat. unit Taxon	Cattle	Pig	Sheep/Goat	Sheep	Goat	Dog	Red deer	Total
Horncore/Antler	0	N/A	0	0	0	N/A	0	0
Mandible/loose teeth	0	5 (7)	1 (5)	6	1	1 (2)	1	15 (22)
Atlas	0	0	0	0	0	0	0	0
Axis	0	0	0	0	0	0	0	0
Scapula	0	0	0	0	0	0	0	0
Humerus P	0	1	1	0	0	0	0	2
Humerus D	0	1	1	0	0	0	0	2
Radius P	0	1	1	1	1	0	0	4
Ulna	0	0	1	0	0	0	0	1
Radius D	0	1	1	1	0	0	0	3
Metacarpus P	0	1	0	0	0	0	0	1
Metacarpus D	0	1	0	0	0	0	0	1
Pelvis	0	1 (2)	0 (1)	0	0	0	0	1 (3)
Femur P	0	1	1	0	0	0	0	2
Femur D	0	0	2	0	0	0	0	2
Tibia P	0	0	1	0	0	0	0	1
Tibia D	0	1	0	0	0	0	0	1
Astragalus	0	0	1	1	0	0	0	2
Calcaneus	0	0	0	0	0	0	0	0
Metatarsus P	0	0	0	0	0	0	0	0
Metatarsus D	1	0	0	0	0	0	0	1
1st Phalanx	0	0	2	0	0	0	0	2
2nd Phalanx	0	0	0	1	0	0	0	1
3rd Phalanx	0	0	0	0	0	0	0	0
Total	1	14 (17)	13	10	2	1	1	42 (51)

Chamber B (Final Neolithic)

Anat. unit	Taxon	Cattle	Pig	Sheep/Goat	Sheep	Goat	Dog	Red deer	Fox	Hare	Badger	Cat	Marten	Hedgehog	Canid	Mustelid	Total
	Horncore/Antler	1	N/A	0	5 (13)	10 (17)	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17 (32)
	Mandible/loose teeth	4	4 (6)	6 (15)	24 (30)	25 (30)	0	2	1	1	0	1	0	1	1	0	70 (92)
	Atlas	1	4	13	0	0	0	0	0	0	1	0	0	0	0	0	19
	Axis	1	1	7	0	0	0	0	1	0	0	0	0	0	0	0	10
	Scapula	0	19 (25)	13 (40)	25	23 (24)	2	4 (5)	1	0	0	0	0	0	0	1	88 (123)
	Humerus P	0	23 (25)	18 (33)	12 (15)	18 (20)	1	0	0	0	0	1	0	1	0	0	74 (96)
	Humerus D	1	30 (32)	19 (34)	20	26	1 (2)	0	0	0	0	1	0	1	1	0	100 (118)
	Radius P	3	17	37 (56)	31	14	2	4 (6)	0	1	0	0	1	0	0	1	111 (132)
	Ulna	3	14 (16)	33	0	4	0	1	1	2	1	1	0	0	0	0	60 (62)
	Radius D	3	17	32 (47)	28 (29)	8	1	0	1	0	0	0	1	0	0	1	92 (108)
	Metacarpus P	1	15	5 (7)	34 (35)	20	0	1	0	2	0	0	0	0	0	0	77 (81)
	Metacarpus D	6	12 (15)	5 (9)	36 (39)	17 (20)	0	0	0	2	0	0	0	0	0	0	77 (91)
	Pelvis	1 (2)	13 (14)	34 (71)	23	11 (12)	0	2 (4)	0	2	0	0	0	0	0	0	86 (128)
	Femur P	1	30	70 (100)	5 (6)	3	0	1 (2)	1	1	0	0	0	0	0	0	112 (144)
	Femur D	2	28 (29)	75 (126)	2 (3)	2 (3)	2	1	0	1	0	0	0	0	0	0	113 (167)
	Tibia P	2	22 (30)	55 (81)	6	2	0	0	1	2	1	0	0	1	1	0	93 (127)
	Tibia D	0	29 (37)	56 (74)	9	5	0	3	0	1	1	0	0	1	1	0	106 (133)
	Astragalus	4	6	0	16	13	0	0	0	0	0	0	0	0	0	0	39
	Calcaneus	2	9	8	19	11	1	1	0	2	0	0	0	0	0	0	53
	Metatarsus P	0	14	22 (26)	14 (18)	23	1	3 (4)	3	1	0	0	0	0	0	0	81 (90)
	Metatarsus D	4	13 (14)	11 (16)	20 (22)	20 (23)	1	1 (3)	3	1	0	0	0	0	0	0	74 (87)
	1st Phalanx	6	9	21 (24)	20	13	0	6	1	0	0	0	0	0	0	0	76 (79)
	2nd Phalanx	3	3	1	5	2	0	4	0	0	0	0	0	0	0	0	18
	3rd Phalanx	2	2	2	3	2	0	2	0	0	0	0	0	0	0	0	13
	Total	51 (52)	334 (370)	543 (823)	357 (387)	272 (295)	12 (13)	37 (46)	14	20	4	4	2	5	4	3	1661 (2042)

Chamber D (Final Neolithic)

<i>Anat. unit Taxon</i>	<i>Cattle</i>	<i>Pig</i>	<i>Sheep/Goat</i>	<i>Sheep</i>	<i>Goat</i>	<i>Dog</i>	<i>Red deer</i>	<i>Fox</i>	<i>Hare</i>	<i>Cat</i>	<i>Marten</i>	<i>Hedgehog</i>	<i>Total</i>
Horncore/Antler	0	N/A	1	0	8	N/A	0	N/A	N/A	N/A	N/A	N/A	9
Mandible/loose teeth	0	2 (3)	1 (2)	3 (6)	5	0	0	2	0	0	1	0	14 (19)
Atlas	0	1	4	0	0	0	0	0	0	0	0	0	5
Axis	1	0	2	0	0	0	0	0	0	0	0	0	3
Scapula	3	10	6	13	7	0	1	0	0	0	0	0	40
Humerus P	2	2	7 (8)	8	2	0	0	0	0	0	0	0	21 (22)
Humerus D	2	2	8	8	6	1	0	0	0	0	0	0	27
Radius P	1 (2)	3	12 (14)	15	1 (2)	2	1	0	0	1	0	0	36 (40)
Ulna	0	4	12	0	0	0	1	0	0	0	0	0	17
Radius D	1	2	13 (14)	14	3	1	2	0	0	1	0	0	37 (38)
Metacarpus P	0	4	3	9	3	0	0	0	0	0	0	0	19
Metacarpus D	0	4	3	10 (11)	3	0	0	0	0	0	0	0	20 (21)
Pelvis	1	5	8 (9)	9	4	0	1	0	0	0	0	0	28 (29)
Femur P	1	2 (3)	19 (21)	5	0	0	2 (3)	0	0	0	0	0	29 (33)
Femur D	0	7	18 (23)	1	0	0	0	0	0	0	0	0	26 (32)
Tibia P	1	6	23 (26)	0	1 (2)	0	1	1	1	0	0	2	36 (40)
Tibia D	1	4	14 (16)	5	8	0	1	1	1	0	0	2	37 (39)
Astragalus	0	1	0	0	0	0	0	0	0	0	0	0	1
Calcaneus	3	3	1	2	0	0	0	0	0	0	0	0	9
Metatarsus P	0	3	7 (9)	6	6	0	0	0	1	0	0	0	24 (25)
Metatarsus D	1	3	4 (5)	6	6	0	0	0	1	0	0	0	21 (22)
1st Phalanx	0	2	6	0	1	0	1	0	0	0	0	0	10
2nd Phalanx	0	0	0	1	0	0	0	0	0	0	0	0	1
3rd Phalanx	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	18 (19)	70 (72)	172 (193)	115 (119)	64 (66)	4	12 (13)	4	4	2	1	4	470 (501)

Chamber B (Early–Final Neolithic)

<i>Anat. unit Taxon</i>	<i>Cattle</i>	<i>Pig</i>	<i>Sheep/Goat</i>	<i>Sheep</i>	<i>Goat</i>	<i>Dog</i>	<i>Red deer</i>	<i>Fox</i>	<i>Hare</i>	<i>Hedgehog</i>	<i>Total</i>
Horncore/Antler	0	N/A	0	0	0	N/A	0	N/A	N/A	N/A	0
Mandible/loose teeth	2	0	1	3	3	0	0	0	0	1	10
Atlas	0	1	0	0	0	0	0	0	0	0	1
Axis	0	0	1	0	0	0	0	0	0	0	1
Scapula	2 (3)	3	2 (5)	0	1	0	0	0	1	0	9 (13)
Humerus P	0	0	5	4	5	0	0	0	1	0	15
Humerus D	1	3	6	5	6	0	1	0	1	0	23
Radius P	0	3	3	6	0	0	0	0	0	0	12
Ulna	0	3	2	0	0	0	0	0	0	0	5
Radius D	1	2 (4)	4	5	0	0	0	0	0	0	12 (14)
Metacarpus P	0	0	3 (5)	1	1	0	0	0	0	0	5 (7)
Metacarpus D	0	0	2 (4)	1	1	0	0	0	0	0	4 (6)
Pelvis	0	2	6 (7)	1	0	1	1	0	0	0	11 (12)
Femur P	0	2	3 (6)	0	0	0	1	0	0	0	6 (9)
Femur D	0	2	5 (9)	0	0	0	0	0	0	0	7 (11)
Tibia P	1	2	12 (16)	0	1	0	1 (2)	0	0	0	17 (22)
Tibia D	0	2	12 (20)	1	1	0	0	0	0	0	16 (24)
Astragalus	0	0	0	0	1	0	0	0	0	0	1
Calcaneus	1	0	0	1	0	0	0	0	0	0	2
Metatarsus P	0	0	2 (3)	5 (7)	0	0	0	1	0	0	8 (11)
Metatarsus D	0	0	2	4	0	0	0	1	0	0	7 (9)
1st Phalanx	0	0	4	2	1	0	1	0	0	0	8
2nd Phalanx	0	0	0	0	0	0	0	0	0	0	0
3rd Phalanx	0	1	0	0	0	0	1	1	0	0	3
Total	8	26	75	39	21	1	6	3	3	1	183 (219)

Chamber Z (Early–Final Neolithic)

<i>Anat. unit Taxon</i>	<i>Cattle</i>	<i>Pig</i>	<i>Sheep/Goat</i>	<i>Sheep</i>	<i>Goat</i>	<i>Dog</i>	<i>Red deer</i>	<i>Hare</i>	<i>Total</i>
Horncore/Antler	0	N/A	0	0	1	N/A	0	N/A	1
Mandible/loose teeth	0	1 (2)	1 (2)	1	0	1	2	0	6 (8)
Atlas	0	0	1	0	0	0	0	0	1
Axis	0	1	1	0	0	0	0	0	2
Scapula	0	2 (3)	1 (3)	1	0	0	0	0	4 (7)
Humerus P	0	0	4 (5)	2	1	0	0	0	7 (8)
Humerus D	0	2	3	2	1	0	0	0	8
Radius P	0	0	7 (9)	1	1	0	0	0	9 (11)
Ulna	0	1	4 (5)	0	0	0	0	0	5 (6)
Radius D	0	0	8	1	0	0	0	0	9
Metacarpus P	0	1	0	4	1	0	0	0	6
Metacarpus D	0	1 (2)	1 (4)	5	1	0	0	0	8 (12)
Pelvis	0	4 (5)	8 (14)	4	1	0	0	0	17 (24)
Femur P	0	2 (4)	4 (6)	1	0	0	0	0	7 (11)
Femur D	0	0	5 (7)	0	0	0	0	0	5 (7)
Tibia P	0	1	8 (10)	1	0	0	0	0	10 (12)
Tibia D	0	1	7	2	0	0	0	1	11
Astragalus	0	0	1	2	1	0	0	0	4
Calcaneus	0	0	0	1 (2)	0	0	0	0	1 (2)
Metatarsus P	0	1 (2)	1	1	0	0	0	0	3 (4)
Metatarsus D	0	1 (2)	3 (4)	3	1	0	0	0	8 (10)
1st Phalanx	0	2	7 (8)	1	0	0	0	0	10 (11)
2nd Phalanx	0	2	2	3	0	0	0	0	7
3rd Phalanx	1	1	1	0	0	0	0	0	3
Total	1	24 (32)	78 (102)	36 (37)	9	1	2	1	152 (185)

Chamber B (Late/Final Neolithic)

<i>Anat. unit Taxon</i>	<i>Cattle</i>	<i>Pig</i>	<i>Sheep/Goat</i>	<i>Sheep</i>	<i>Goat</i>	<i>Dog</i>	<i>Red deer</i>	<i>Fox</i>	<i>Hare</i>	<i>Badger</i>	<i>Total</i>
Horncore/Antler	0	N/A	0	1	1	N/A	1	N/A	N/A	N/A	3
Mandible/loose teeth	0	4 (6)	2 (6)	3	3	0	1	0	0	0	13 (19)
Atlas	0	2	1	0	0	0	0	1	0	0	4
Axis	0	0	4	0	0	0	0	0	0	0	4
Scapula	3 (4)	4 (7)	3 (12)	7	5	1	0	0	0	0	23 (36)
Humerus P	0	3	4 (9)	7	5 (7)	0	0	0	0	0	19 (26)
Humerus D	0	4	2 (4)	13	11	1	0	0	0	0	31 (33)
Radius P	0	2	17 (20)	11	1	1	0	0	0	0	32 (35)
Ulna	0	5 (6)	14	0	1	0	0	0	1	0	21 (22)
Radius D	0	3	14 (17)	8 (10)	2 (3)	1	0	0	0	0	28 (34)
Metacarpus P	0	6	1	12	7 (8)	0	0	0	0	0	26 (27)
Metacarpus D	0	6	1	12 (13)	7 (8)	0	0	0	0	0	26 (28)
Pelvis	0	4 (5)	11 (18)	5	3	1	0	0	0	0	24 (32)
Femur P	1	4	21 (30)	2	0	0	0 (1)	0	0	0	28 (38)
Femur D	0	4	23 (32)	0	0	0	1	0	0	1	29 (38)
Tibia P	1 (2)	4 (5)	23 (34)	2	0	0	0	0	0	0	30 (43)
Tibia D	0	3	28 (36)	6	4	0	0	0	0	0	41 (49)
Astragalus	0	1	0	0	1	0	0	0	0	0	2
Calcaneus	2	3	1	1	2	0	0	0	0	0	9
Metatarsus P	2	6	2 (5)	14 (16)	6	0	0	1	0	0	31 (36)
Metatarsus D	1 (2)	6 (7)	1 (3)	15 (16)	5	0	0	1	0	0	29 (34)
1st Phalanx	4	0	2	2	6	0	2	0	0	0	16
2nd Phalanx	2	0	0	0	0	0	2	0	0	0	4
3rd Phalanx	1	0	0	0	1	0	0	0	0	0	2
Total	17 (20)	74 (83)	175 (250)	121 (127)	71 (76)	5	7 (8)	3	1	1	475 (574)

Chamber B (Late/Final Neolithic)

<i>Anat. unit Taxon</i>	<i>Cattle</i>	<i>Pig</i>	<i>Sheep/ Goat</i>	<i>Sheep</i>	<i>Goat</i>	<i>Dog</i>	<i>Red deer</i>	<i>Fox</i>	<i>Hare</i>	<i>Cat</i>	<i>Marten</i>	<i>Hedgehog</i>	<i>Total</i>
Horncore/Antler	1	N/A	0	1	0 (1)	N/A	0	N/A	N/A	N/A	N/A	N/A	2 (3)
Mandible/loose teeth	0	5 (7)	1 (3)	8 (12)	8 (10)	0	1	1	0	0	0	1 (2)	25 (36)
Atlas	1	1	2	0	0	0	0	0	0	0	0	0	4
Axis	0	0	6	0	0	0	0	0	0	0	0	0	6
Scapula	2 (4)	10 (11)	6 (17)	8 (9)	7	0	4	0	0	0	0	0	37 (52)
Humerus P	2	5	5 (10)	4 (5)	6	1	0	0	0	1	0	0	24 (30)
Humerus D	1 (3)	12 (13)	5 (7)	9 (10)	6	1	1	0	0	1	0	1	37 (43)
Radius P	3	4	15 (22)	12	4	1	1	0	0	0	1	0	41 (48)
Ulna	3	3	13	0	2	2	0	0	0	0	0	0	23
Radius D	2	4	10 (14)	9 (10)	2	0	1	0	0	0	1	0	29 (34)
Metacarpus P	2	5	0 (1)	10	3	0	1	1	0	0	0	0	22 (24)
Metacarpus D	0	4	0 (1)	7 (8)	3 (4)	0	0	1	0	0	0	0	15 (18)
Pelvis	0	5 (6)	8 (20)	11	5 (6)	0	0	0	0	0	0	0	29 (43)
Femur P	0	2	10 (21)	1	0	0	0	0	0	0	0	0	13 (24)
Femur D	0	3	14 (30)	0	0	0	0	0	0	0	0	0	17 (33)
Tibia P	4 (6)	5	23 (35)	1	0	0	0	0	0	0	0	0	33 (47)
Tibia D	2	5 (7)	20 (30)	5	2	0	2	0	1	0	0	0	37 (49)
Astragalus	2	2	1	4	0	0	1	0	0	0	0	0	10
Calcaneus	2 (3)	6	1	1	3	0	0	0	0	0	0	0	13 (14)
Metatarsus P	2 (3)	2	0 (3)	8	1	0	0 (1)	1	1	0	0	0	14 (19)
Metatarsus D	0	2	1 (4)	10	3	0	1	1	0	0	0	0	18 (21)
1st Phalanx	1	0	2	5	1	0	1	0	0	0	1	0	11
2nd Phalanx	2	1	0	1	0	0	1	0	0	0	0	0	5
3rd Phalanx	0	0	1	3	0	0	1	0	0	0	0	0	5
Total	32 (40)	86 (93)	144 (244)	118 (127)	56 (61)	5	16 (17)	5	2	2	3	2 (3)	471 (602)

Lake Chamber (Final Neolithic?)

<i>Anat. unit Taxon</i>	<i>Pig</i>	<i>Sheep/ Goat</i>	<i>Sheep</i>	<i>Goat</i>	<i>Total</i>
Horncore/Antler	N/A	0	0	0	0
Mandible/loose teeth	0	1	3	0	4
Atlas	0	0	0	0	0
Axis	0	1	0	0	1
Scapula	0	0	0	0	0
Humerus P	0	0	1	0	1
Humerus D	0	0	2	1	3
Radius P	0	1	1	1	3
Ulna	0	1	0	0	1
Radius D	0	1	1	1	3
Metacarpus P	0	0	1	0	1
Metacarpus D	0	0	1	0	1
Pelvis	0	0	1	0	1
Femur P	2	2	0	0	4
Femur D	1	4 (5)	0	0	5 (6)
Tibia P	0	1	2	0	3
Tibia D	0	0	3	0	3
Astragalus	0	0	0	0	0
Calcaneus	0	0	0	0	0
Metatarsus P	0	0	0	0	0
Metatarsus D	0	0	0	0	0
1st Phalanx	0	0	0	0	0
2nd Phalanx	0	0	0	0	0
3rd Phalanx	0	0	0	0	0
Total	3	12 (13)	16	3	34 (35)

Neolithic 'staircase' (Final Neolithic?)

<i>Anat. unit Taxon</i>	<i>Pig</i>	<i>Sheep/ Goat</i>	<i>Sheep</i>	<i>Goat</i>	<i>Red deer</i>	<i>Total</i>
Horncore/Antler	N/A	0	0	0	0	0
Mandible/loose teeth	1 (2)	1	1	0	0	3 (4)
Atlas	0	0	0	0	0	0
Axis	0	2	0	0	0	2
Scapula	2	0	0	0	0	2
Humerus P	0	0	0	0	0	0
Humerus D	0	0	0	0	0	0
Radius P	0	0	0	1	0	1
Ulna	0	0	0	0	1	1
Radius D	0	0	0	0	0	0
Metacarpus P	1	0	0	1	0	2
Metacarpus D	1 (2)	0	0	0	0	1
Pelvis	0	0	0	0	0	0
Femur P	0	1 (2)	0	0	0	1 (2)
Femur D	0	1	0	0	0	1
Tibia P	0	2	0	0	0	2
Tibia D	0	0	0	0	0	0
Astragalus	0	0	1	0	0	1
Calcaneus	0	0	0	0	0	0
Metatarsus P	0	0	0	0	0	0
Metatarsus D	0	1	0	0	0	1
1st Phalanx	0	1	1	0	0	2
2nd Phalanx	0	0	0	0	0	0
3rd Phalanx	0	0	0	1	0	1
Total	5 (7)	9 (10)	3	3	1	21 (24)

Loci 15–19 (Chamber E?) (Final Neolithic?)

<i>Anat. unit Taxon</i>	<i>Pig</i>	<i>Sheep/Goat</i>	<i>Sheep</i>	<i>Total</i>	<i>Anat. unit Taxon</i>	<i>Pig</i>	<i>Sheep/Goat</i>	<i>Sheep</i>	<i>Total</i>
Horncore/Antler	N/A	0	0	0	Femur P	1	0	0	1
Mandible/loose teeth	0	0	0	0	Femur D	1	0	0	1
Atlas	0	0	0	0	Tibia P	0	0	0	0
Axis	0	0	0	0	Tibia D	0	0	0	0
Scapula	0	1	0	1	Astragalus	0	0	1	1
Humerus P	0	0	0	0	Calcaneus	0	0	0	0
Humerus D	0	0	0	0	Metatarsus P	0	1	1	2
Radius P	0	1	1	2	Metatarsus D	0	0 (1)	1	1 (2)
Ulna	0	0	0	0	1st Phalanx	0	0	0	0
Radius D	1	1	1	3	2nd Phalanx	0	0	0	0
Metacarpus P	1	0	0	1	3rd Phalanx	0	0	0	0
Metacarpus D	1	0	0	1	Total	5	4 (5)	5	14 (15)
Pelvis	0	0	0	0					

Radiogenic strontium isotope results from the burials of Alepotrypa Cave

Julia I. Giblin

Introduction

Southern Greece in the Neolithic period represents one of the first locations in Europe settled by migrating farming societies from south-west Asia, starting around 6,800 BC. The introduction of domesticated plants and animals, along with new people and cultural characteristics, resulted in major changes in material culture, technology and social organisation. In some cases, agriculture provided the foundation for Europe's first 'complex' societies, emerging a few millennia later during the Bronze Age. Many questions remain about this transitional period in south-east Europe, and the inhabitants of Alepotrypa Cave provide a unique opportunity to study the impact of farming on human societies in this region.

Alepotrypa Cave is a well-known archaeological site located on the coast of Diros Bay on the Mani peninsula in southern Greece. It is one of the richest and best-preserved archaeological sites in Greece, being utilised from the late Early Neolithic to the Final Neolithic period (c. 6,000–3,200 BC) (Papathanasiou *et al.* 2000, this volume). The cave is located in an arid, rocky limestone environment about 50 m from the Mediterranean shoreline. It is approximately 300 m long and includes several chambers and passageways that were used by the Neolithic inhabitants of the region as a place to live, and also to bury their dead. A freshwater lake at the rear of the cave provided an important source of potable water in a region where fresh water is scarce.

It is thought that earthquake activity resulted in the collapse of the cave entrance towards the end of the Neolithic period, thereby preserving the cave's contents for thousands of years. The cave entrance was re-discovered by the Greek Speleological Society in 1958. Originally developed as a tourist attraction, the Greek Ministry of

Culture recognised the archaeological significance of the site and assumed management. Archaeologists (led by G. Papathanassopoulos) have been excavating the cave since the 1970s and have determined that the site served as a place where people lived, acquired fresh water, buried their dead, and perhaps gathered for communal purposes. In some places in the cave, up to six metres of intact archaeological deposits have been recorded (Papathanassopoulos 1996).

Finds include animal bones and plant remains from both wild and domesticated species, and a range of artefact types (lithics, pottery, hand axes, grinding stones, bone needles, clay spindle whorls, marble and clay figurines, shell and stone beads, and silver jewellery). Features like hearths, deep storage pits, and round clay ovens indicate that members of the Neolithic community occupied the cave. It also appears to have been an important place for the burial of the dead, because a variety of mortuary rituals have been recorded. There are two areas of the cave identified as ossuaries. At these locations the disarticulated remains of multiple individuals (*i.e.*, secondary burials) have been excavated. Primary burials have been found in deep deposits at the entrance of the cave (Trench B1) and scattered human remains were found at various locations throughout the cave. In fact, Alepotrypa Cave has produced one of the largest collections of human remains from this time period in Greece (Papathanasiou 2005, this volume).

Inhabitants of the cave

Papathanasiou has recently published an extensive bioarchaeological study of the human remains recovered from the cave to assess the impact of farming on human

health (Papathanasiou 2001; 2003; 2005; Papathanasiou *et al.* 2000). While the human remains from the site are highly fragmentary, the preservation of bone is fairly good. She estimates that a minimum of 161 individuals were buried in the cave, with approximately equal proportions of males and females, and adults and subadults (Papathanasiou 2005).

Stable light isotope data ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) suggest that the population ate a diet mainly composed of terrestrial species (cereals, pulses and animals that ate mostly C_3 plants), despite having easy access to marine resources (Papathanasiou 2003; Papathanasiou *et al.* 2000). $\delta^{15}\text{N}$ values were also relatively low when compared to other Neolithic samples in Greece, perhaps indicating that meat and secondary products from domesticated animals (sheep, goats, pigs and cattle) made a lesser contribution to the diet than domesticated plants. Heavy dental wear patterns on the teeth (cupped occlusal surfaces) support the hypothesis that processed grain was a central part of the diet (Papathanasiou 2001).

The impact of this diet on the population appears to be mixed. Incidence of dental disease (caries and enamel defects) and infection was relatively low for a farming population. However, a high percentage of individuals (over 50% of observable specimens) from the cave exhibited anemic conditions, possibly related to dietary deficiencies, although a high parasitic load and/or unsanitary conditions in the cave could also have been disease factors (Papathanasiou 2001; 2005).

Osteoarthritis and musculoskeletal stress markers on the post-cranial bones suggest a high level of physical activity for the people buried in the cave, possibly associated with heavy workloads and excessive walking and running (Papathanasiou 2001). Inter-personal conflict led to violent but non-lethal confrontations in some cases (as evidenced by healed, depressed cranial fractures in 13% of observable specimens) (Papathanasiou 2005). Finally, there is a relatively high frequency of certain non-metric cranial traits that can indicate genetic affinity. Metopism is the most frequent (14.7% for the whole sample; 30.8% from individuals in Ossuary II). Strikingly, four out of the five individuals with this condition come from Ossuary II, which may indicate a familial relationship. Supraorbital notches occur in 78.8% of observable specimens, lambdoidal bones in 43.8%, Inca bones in 8.3%, and sagittal bones in 5.6%.

Research questions and sampling strategy

This study is a preliminary attempt to identify where the people buried at Alepotrypa Cave came from. Archaeological evidence indicates that the cave functioned as a place to access clean water, live and bury the dead. The dead themselves were buried according to multiple mortuary customs, and exhibit a wide range of paleopathological conditions bearing on health, activity

patterns, conflict and genetic abnormalities. Do the burials at Alepotrypa represent a primarily local population of Neolithic farmers? Or, did people come from a wider area of the Aegean to trade goods, find marriage partners, and/or to bury their dead and participate in ritual activities? If non-local individuals exist, how might this correlate with the mortuary ritual associated with the burial, or the osteological characteristics of the population?

One way to characterise the range of human and animal movement in prehistory is to analyse the chemical composition of skeletal material, and specifically look at isotopes that record characteristics of geological location when those tissues were being formed, such as $^{87}\text{Sr}/^{86}\text{Sr}$ and $\delta^{18}\text{O}$. Tissues that were formed in the first few years of life, like the first molars in humans, record where that individual was acquiring food and water resources during their childhood. If this signature does not match the isotopic signature of their burial location, it can indicate a non-local origin. This study presents the first results of $^{87}\text{Sr}/^{86}\text{Sr}$ values from human and animal teeth collected from previous Alepotrypa Cave excavations. $\delta^{18}\text{O}$ results for these samples are forthcoming.

During the summer of 2013, dental enamel samples were collected from humans buried in various locations throughout the cave (the cave entrance, Trench B1, the North Sector and Ossuaries I and II) (Figure 15.1). Samples were selected to represent a few individuals from each context of the cave (*e.g.*, habitation vs. ossuary). Within a given context, individuals of interest were selected (*e.g.*, specimens that exhibited pathologies and/or genetic abnormalities), as well as those that were not associated with any observed pathologies. The sampling strategy for this preliminary study was designed to evaluate whether sufficient isotope variability existed between the inhabitants of the cave to warrant more extensive investigation.

Teeth from archaeological contexts are commonly used for isotopic sampling because their dense mineral structure reduces their susceptibility to contamination in the burial environment (Kohn *et al.* 1999; Budd *et al.* 2000). Molars were used in this study to evaluate where individuals acquired resources during childhood. First molars were preferentially selected because they are formed in the first three years of life (Hillson 2005).

It is also customary to analyze faunal teeth from the same contexts in order to get a more holistic characterisation of the local 'biologically available' isotope variability in a given region (Price *et al.* 2002). Differential weathering rates of minerals and the possibility of acquiring strontium from multiple dietary sources (*e.g.*, marine resources, groundwater, wild animals, etc.) mean that bedrock strontium values cannot be used alone to estimate where humans acquired their strontium signature. Enamel from archaeological and modern animals, preferably species that utilise relatively restricted territories, is often used to approximate the local range around an archaeological

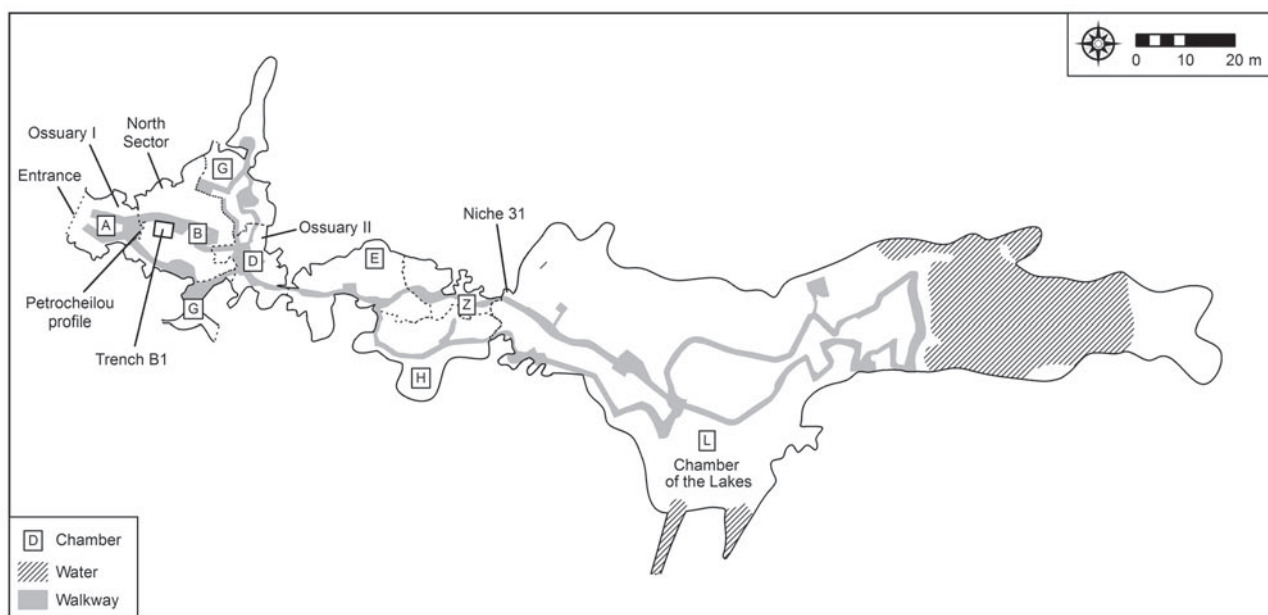


Figure 15.1. Map of Alepotrypa Cave, showing locations where human and animal skeletal material has been recovered.

site. In this study, samples were taken from domesticated animal molars (pigs, sheep/goat and cattle) from various contexts throughout the cave to roughly estimate the local strontium signature for the cave and surrounding region. Modern samples from plants, rocks and snail shells throughout the Mani Peninsula have been collected and will be analyzed in future studies.

Strontium isotope geochemistry and the geology of the Aegean

Strontium (specifically, the isotopic ratio of $^{87}\text{Sr}/^{86}\text{Sr}$) is used as a geological tracer in archaeological material because of two main characteristics: 1) the element is incorporated into teeth and bones of humans and animals via local dietary sources as these tissues are formed, and 2) $^{87}\text{Sr}/^{86}\text{Sr}$ values vary depending on the age and mineral content of local bedrock, soil and water. In regions where sufficient geological variability exists, this technique has been quite useful for identifying various types of human mobility in prehistory, particularly the presence of non-local individuals in burial contexts (for a more detailed description of the methodology, see Giblin 2011; Giblin *et al.* 2013).

^{87}Sr is a stable radiogenic isotope produced by decay from the element rubidium (^{87}Rb , half-life 48.8 billion years). Because ^{87}Rb decays at a constant rate, measurements of ^{87}Sr (relative to the stable nonradiogenic isotope: ^{86}Sr) are used to measure the age and source of rock formations (Faure 1986). This technique can be used to source archaeological samples because strontium digested from soil, groundwater and food resources substitutes for calcium in hydroxyapatite as this skeletal

tissue is formed in vertebrates (Bentley 2006). The strontium isotope ratio in rocks of the continental crust generally varies between 0.702 and 0.750. Geological units greater than 100 million years (that have high original Rb/Sr content) exhibit $^{87}\text{Sr}/^{86}\text{Sr}$ values of 0.710 or greater: such as older granites. Geological units less than 10 million years, like younger basalts, have isotope ratios below 0.704.

Previous radiogenic isotope research on archaeological material throughout the Aegean indicates that there is significant isotopic variability due to the region's complex geological history (Richards *et al.* 2008; Nafplioti 2011; Figure 15.2; CPII 40). Tectonic activity in the Mediterranean over the past 200 million years has resulted in the closure of the Tethys ocean basin and the movement of continental fragments, islands, oceanic ridges and parts of the ocean floor both north and eastwards (Higgins and Higgins 1996). This crustal compression has resulted in a series of tectonic (or isopic) zones that are composed of rocks that share a common depositional history and are bounded by fault lines. These zones are stacked up against both each other and massifs (blocks of metamorphic and plutonic rock that make up slightly lower levels of the continental crust). During this time, much of the Mediterranean was covered by shallow, warm tropical seas, which resulted in the deposition of the abundant limestones that are known throughout the Aegean.

Nafplioti has done the most extensive sampling of archaeological and modern material throughout the southern Aegean. In her 2011 publication, Nafplioti reported 'biologically available' strontium isotope data from archaeological animal enamel samples ($n = 34$),

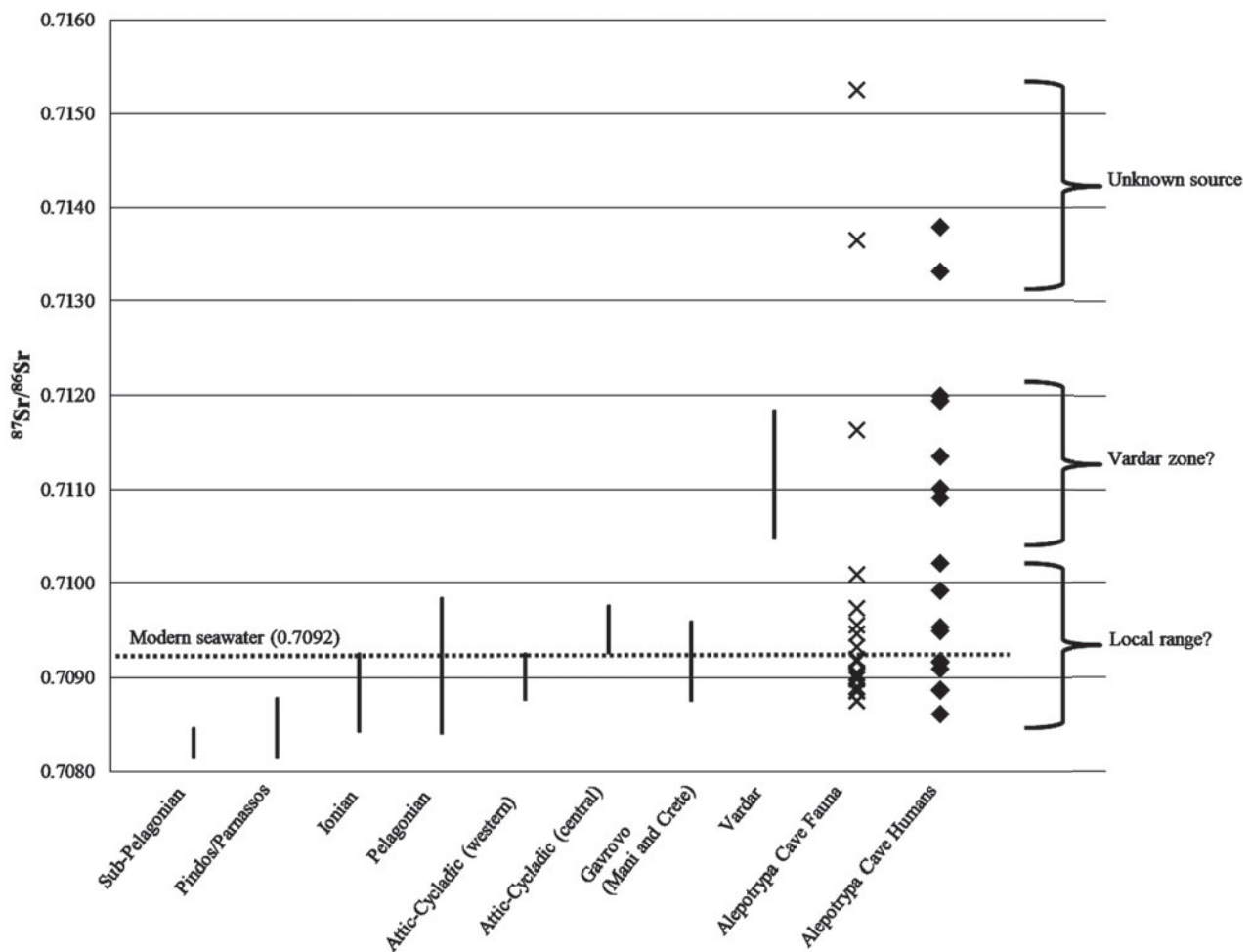


Figure 15.2. Radiogenic Sr isotope data from Alepotrypa Cave compared to previously published regional data from fauna and hominid bone (Nafplioti 2011; Richards et al. 2008). Black lines represent the average $^{87}\text{Sr}/^{86}\text{Sr}$ value for all samples from the region $\pm 1\sigma$.

modern snail shells ($n = 28$), archaeological animal bone ($n = 4$), and one modern animal enamel sample, collected from 21 sites. Archaeological human bone samples from eight sites in this region were also included in the analysis. Nafplioti concluded that there are three relatively distinct isotopic regions that relate to the complex tectonic geological zones of the Aegean (Figure 15.2). The lowest $^{87}\text{Sr}/^{86}\text{Sr}$ values are below the average for modern seawater (0.7092) and were analyzed from samples in the Pindos and Parnassos tectonic zones (Argolid, Corinthia; mean = 0.70846, $n = 14$), and the Sub-Pelagonian zone (Kos; mean = 0.70830, $n = 3$). Intermediate $^{87}\text{Sr}/^{86}\text{Sr}$ values were analysed from samples collected from the Gavrovo zone (Crete, Mani peninsula; mean = 0.70918, $n = 37$), the Pelagonian zone (Euboea, Attica; mean = 0.70912, $n = 11$), the western portion of the Attic-Cycladic metamorphic belt (Kea, Kythnos; mean = 0.70901, $n = 10$), and the Ionian zone (Crete, Rhodes; mean = 0.70883, $n = 3$). The central portion of the Attic-Cycladic Metamorphic belt (Antiparos, Naxos; mean = 0.70950, $n = 9$) exhibited slightly more radiogenic isotope values than the western portion of the zone. The highest and most

radiogenic $^{87}\text{Sr}/^{86}\text{Sr}$ values were analysed from samples in the Vardar zone (Chios; mean = 0.711162, $n = 3$).

Alepotrypa Cave is located within the Gavrovo tectonic zone, which comprises the south-east portion of the Peloponnese. Originally a continental fragment, the Gavrovo zone accumulated limestone deposits during the Mesozoic, whilst submerged beneath a shallow sea (Higgins and Higgins 1996). However, in the late Eocene, mountain formation and weathering covered up much of the limestone with flysch sediments. The Gavrovo zone is stacked within the Pindos (originally a deep sea trench) and Ionian zones (deep water trough, later covered by flysch sediments) that make up the western border of the Aegean.

The geology of the Mani peninsula, in the immediate region surrounding the cave, is underlain by mostly Late Cretaceous to Late Eocene limestone and marble, with layers of clastic sediments and schist. The limestone in this region has been predicted to exhibit $^{87}\text{Sr}/^{86}\text{Sr}$ values between 0.7069 and 0.7078 (McArthur *et al.* 2001). $^{87}\text{Sr}/^{86}\text{Sr}$ data from archaeological faunal samples from Lakonis Cave, a Middle to Upper Palaeolithic site located

Table 15.1. Radiogenic Sr isotope results for humans from Alepotrypa Cave (osteological data from Papathanasiou 2001)

Diros Project Catalog #	CAR Lab #	Tooth sampled	Upper/lower	Age	Sex	Context	General Location	Time Period	Burial type	$^{87}\text{Sr}/^{86}\text{Sr}$	1 sigma error	Disease/stress	Non-metric traits
A2	CAR-0021	L M1	lower	20–30	M	A/2/3, 16-7-70	Entrance – context uncertain	Early Neolithic (?)	Scattered bone	0.71020	0.00009		
A136	CAR-0022	L M1	lower	25–30	F	B/1, 17-25.8.70	Trench B1, centre cave entrance	Final Neolithic (?)	Single, primary burial; higher stratigraphic layer	0.71331	0.00045	Ossified tendon on iliac crest, probable infection of left acetabulum, porotic hyperostosis (mild: thickening not porosity), cribra orbitalia - v. slight, asymmetrical attrition of maxilla, crowded M3 of maxilla, mandible: abscess between left C & P3, dental enamel hypoplasias on lower I2s, Cs & Ps, calculus, cupped wear	Supraorbital notch
A2198	CAR-0024	L M1	lower	9	?	Δ45	Trench B1, centre cave entrance	Late Neolithic (?)	Multiple, primary burial; lowest stratigraphic layer excavated	0.70991	0.00017		
A2197	CAR-0025	R M1	upper	30	F	σκαλ. A & Ω 28	Trench B1 – centre of cave entrance	Late Neolithic (?)	Multiple, primary burial; lowest stratigraphic layer excavated	0.70861	0.00008		
A194	CAR-0026	L M1	lower	10	?	B/7/129, 15-2-71	North sector	Final Neolithic	Scattered bone	0.70949	0.00013		
A1890	CAR-0028	R M1	upper	c. 30	M?	A/4/23/471, 6-7-94	Ossuary I	Early Neolithic	Secondary burial, multiple individuals; possible primary burials of 4 subadults	0.71199	0.00016	Cribra orbitalia – mild healed, hypoplasia LP4, angled wear, maleruption, abscess, premortem tooth loss	Supraorbital notch
A1997	CAR-0029	R M1	lower	20–25	?	A/4/B2/456, 2-7-94	Ossuary I	Early Neolithic	Secondary burial, multiple individuals; possible primary burials of 4 subadults	0.71135	0.00033		
A2059	CAR-0030	R M1	lower	10–11	F?	A/4/Γ/4/73, 5-7-94	Ossuary I	Early Neolithic	Secondary burial, multiple individuals; possible primary burials of 4 subadults	0.71092	0.00036	Calculus	
A231	CAR-0031	R M1	upper	8	?	Θ.10/dIII-IIα/185/14 28-8-71	Ossuary II	Final Neolithic	Secondary burial, multiple individuals	0.70908	0.00011	Maleruption RC	

A232	CAR-0032	R dM2	upper	8	?	Θ.10/dIII-IIa/185/12 28-8-71	Ossuary II	Final Neolithic	Secondary burial, multiple individuals	0.70915	0.00010	Metopic suture, supraorbital notch
A234	CAR-0033	L M1	upper	10	?	Θ.9/fIII-IIa/184/3 30-8-71	Ossuary II	Final Neolithic	Secondary burial, multiple individuals	0.71380	0.00016	Hypoplasias LC
A559	CAR-0034	R M1	upper	30	M	Δ/Oct II/26α	Ossuary II	Final Neolithic	Secondary burial, multiple individuals	0.70917	0.00008	
A235	CAR-0035	L M1 (?)	upper	14-15	F	Θ.9/eIV-IIa/187/5 30-8-71	Ossuary II	Final Neolithic	Secondary burial, multiple individuals	0.71101	0.00014	Cribr orbitalia Supraorbital notch, postcoronal deformation, lamdoidal bones, inca bones
A1874	CAR-0036	R M1 (?)	upper	3 to 7	?	Θ.9/185? 30-8-71	Ossuary II	Final Neolithic	Secondary burial, multiple individuals	0.70952	0.00014	
A14	CAR-0037	L M1	lower	30-35	M?	Θ.24, 18-7-70	Area Z	n/a	Scattered human bone from Area Z; possible ritual area (burned dung; painted ceramics)	0.71194	0.00033	Caries on RP3, M3, calculus, postmortem tooth loss of LM2, M3, RC, malerupted M3s, I2, cupped wear
A46	CAR-0038	R M1	upper	30+	?	Θ.24, 18-7-70	Area Z	n/a	Scattered human bone from Area Z; possible ritual area (burned dung; painted ceramics)	0.70886	0.00009	Calculus, sever angular wear
ΛA1/ Th31	CAR-0065	R (?) M2 (?)	upper	n/a	n/a	n/a	Area Z	Final Neolithic	Multiple, primary burial; two children (thought to be cremated) buried underneath a large amount of broken pottery	0.70886	0.00004	n/a

Table 15.2. Radiogenic Sr isotope results for fauna from Alepotrypa Cave

Diros Project Catalog #	CAR Lab #	Species	Sample location on tooth	Context	General Location	Time Period	$^{87}\text{Sr}/^{86}\text{Sr}$	1 sigma error
Z.45	CAR-0073	<i>Ovis/Capra</i> (sheep/goat)	CEJ	A/4/9 12-8-70	Ossuary I	Early Neolithic	0.71163	0.00016
Z.49	CAR-0041	<i>Ovis/Capra</i> (sheep/goat)	Crown	A/4/13 12-8-70	Ossuary I	Early Neolithic	0.70919	0.00031
Z.54	CAR-0043	<i>Ovis/Capra</i> (sheep/goat)	Crown	A/4/17 2-8-70	Ossuary I	Early Neolithic	0.71009	0.00066
n/a	CAR-0044	<i>Bos Taurus</i> (cattle)	Crown	A/4/13 12-8-70	Ossuary I	Early Neolithic	0.71525	0.00012
T.269	CAR-0050	<i>Sus domesticus</i> (pig)	Whole cusp	Z/22/664	Area Z	n/a	0.70890	0.00008
T.269	CAR-0051,74	<i>Ovis/Capra</i> (sheep/goat)	Crown, CEJ	Z/22/664	Area Z	n/a	0.70954; 0.70932	0.00029; 0.00036
T.283	CAR-0052	<i>Ovis/Capra</i> (sheep/goat) ?	Crown	Z/22/666	Area Z	n/a	0.70946	0.00048
T.269	CAR-0053	<i>Ovis/Capra</i> (sheep/goat)	Crown	Z/22/664	Area Z	n/a	0.70884	0.00012
T.283	CAR-0054	<i>Ovis/Capra</i> (sheep/goat) ?	Crown	Z/22/666	Area Z	n/a	0.70875	0.00010
T.283	CAR-0056	<i>Ovis/Capra</i> (sheep/goat) ?	Crown	Z/22/666	Area Z	n/a	0.70898	0.00026
Z.189	CAR-0057	<i>Ovis/Capra</i> (sheep/goat)	Crown	B/1/22 19-8-70	Trench B1	Final Neolithic	0.70875	0.00008
Z.230	CAR-0058	<i>Ovis/Capra</i> (sheep/goat)	Crown	B/1/35 20-8-70	Trench B1	Final Neolithic	0.70901	0.00013
Z.359	CAR-0059	<i>Ovis/Capra</i> (sheep/goat)	Crown	B/1/81 15-12-70	Trench B1	Final Neolithic	0.70973	0.00026
Z.204	CAR-0060	<i>Sus domesticus</i> (pig)	Whole cusp	B/1/27 19-8-70	Trench B1	Final Neolithic	0.70903	0.00010
Z.269	CAR-0061	<i>Sus domesticus</i> (pig)	Whole cusp	B/1/46 22-8-70	Trench B1	Final Neolithic	0.70905	0.00008
Z.198	CAR-0062	<i>Sus domesticus</i> (pig)	Whole cusp	B/1/27 19-8-70	Trench B1	Final Neolithic	0.70917	0.00013
Z.317	CAR-0063	<i>Sus domesticus</i> (pig)	Whole cusp	B/1/49 24-8-70	Trench B1	Final Neolithic	0.70885	0.00006
Z.360	CAR-0064	<i>Sus domesticus</i> (pig)	Whole cusp	B/1/89 15-12-70	Trench B1	Final Neolithic	0.71365	0.00007

on the north-east coast of the Mani peninsula exhibited an enamel value of 0.7098 ± 0.0003 (1σ) for a rhino tooth and 0.7126 ± 0.0004 (1σ) for a deer tooth. The deer enamel was interpreted as being non-local due to the much higher value. The Krokeai region located approximately 20 km to the north was suggested as a possible source of more radiogenic strontium.

Results

For conducting the isotope analysis, human and faunal enamel (5–10 mg) was taken from molars. Enamel was mechanically cleaned and isolated using a diamond drill bit attached to a Dremel tool; the work was carried out in the Center for Anthropological Research Laboratory at Quinnipiac University according to procedures described in Giblin (2011). Enamel samples were chemically processed and analysed for their isotope composition in an under-class 10 clean laboratory at the Kline Geology Laboratory at Yale University. The $^{87}\text{Sr}/^{86}\text{Sr}$ ratios were measured using MC-ICP-MS (NEPTUNE), and corrected for mass bias using $^{88}\text{Sr}/^{86}\text{Sr} = 8.375209$. The routine measurement of the NBS-987 standard obtained 0.71030 ± 0.00002 . Carbonate (contemporary coral) and seawater (Vineyard Sound seawater) standards were processed along with leached dolomite solutions (0.70917 ± 0.00002).

$^{87}\text{Sr}/^{86}\text{Sr}$ ratios were obtained from 17 humans (Table 15.1) and 18 faunal specimens (Table 15.2). The human samples ranged from 0.70861 to 0.71380, with a mean value of 0.71042. The animal data ranged from 0.70875 to 0.71525, with a mean value of 0.70981. A majority of the samples, particularly the fauna, are consistent with samples measured from the Gavrovo

tectonic zone, although the spread is a bit broader (0.7085–0.7102) (Figure 15.2). This provides a preliminary estimate of the local range of biologically available strontium for the Mani peninsula. It is important, however, to note that this range overlaps with several of the tectonic zones in the southern Aegean, which would therefore mask prehistoric mobility patterns if individuals grew up in these other regions, but were buried at Alepotrypa Cave. A second cluster of human and animal data points exists: between 0.7110–0.7120, this overlaps with the more radiogenic values found in the Vardar tectonic zone (Chios). Finally, there is a third cluster of radiogenic values (between 0.7130–0.7150) that are higher than any archaeological strontium isotope data previously published for the Aegean.

When the data are organised by the location where they were excavated within Alepotrypa Cave, no distinctive patterns emerge (Figure 15.3). The humans with the highest values were buried in Trench B1 and Ossuary II (CAR-0022, 33), which include both primary and secondary burials. Individuals whose values match the Vardar zone were buried in Ossuaries I and II and Area Z (CAR-0028, 29, 30, 35, 37). Individuals with estimated local values are found in all areas, except Ossuary I (CAR-0021, 24, 25, 26, 31, 32, 34, 36, 38, 65). Elevated radiogenic strontium values from animals are associated with three different species (cattle, sheep/goat, and pig) and come from three different locations.

The data were also divided into separate categories based on paleopathological observations (Figure 15.4). These include: no observable pathology, evidence for disease, evidence for disease and presence of non-metric trait(s), and presence of non-metric traits only (paleopathological designations are listed in Table 1). A majority of the individuals with no observable pathologies

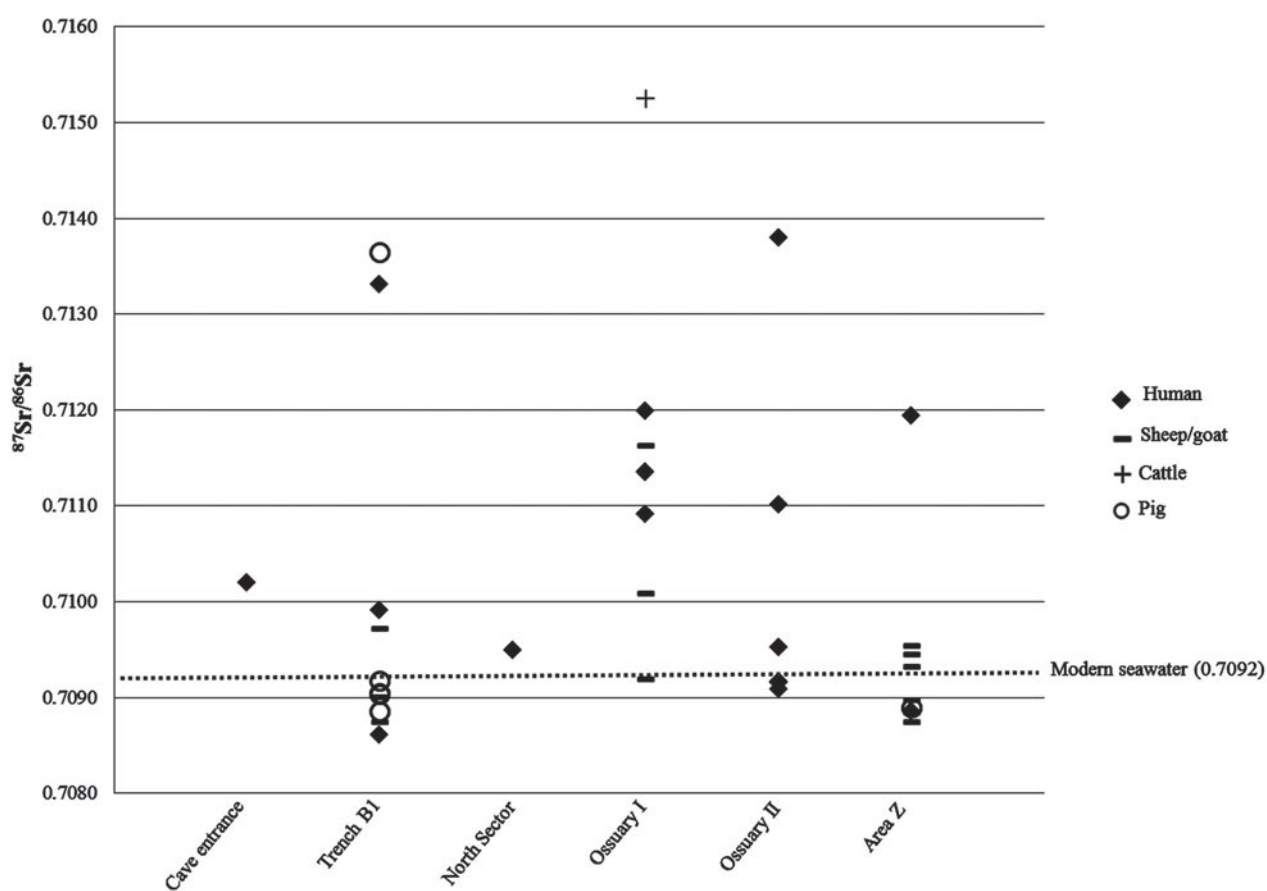


Figure 15.3. Radiogenic Sr isotope data for humans and domesticated fauna from Alepotrypa Cave. Samples are organized by region of the cave. See Figure 15.1 for location.

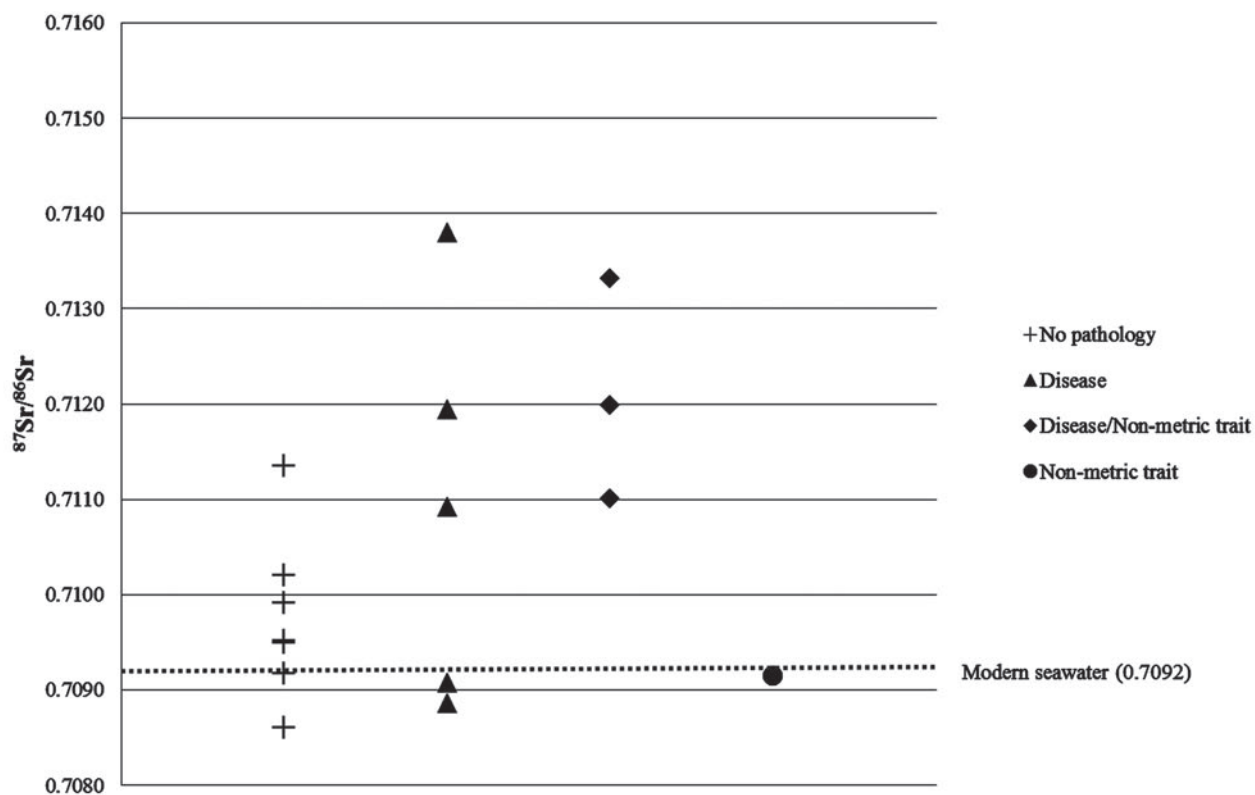


Figure 15.4. Radiogenic Sr isotope data for humans from Alepotrypa Cave. Samples are separated according to the presence or absence of paleopathological designations (osteological data from Papathanasiou 2001).

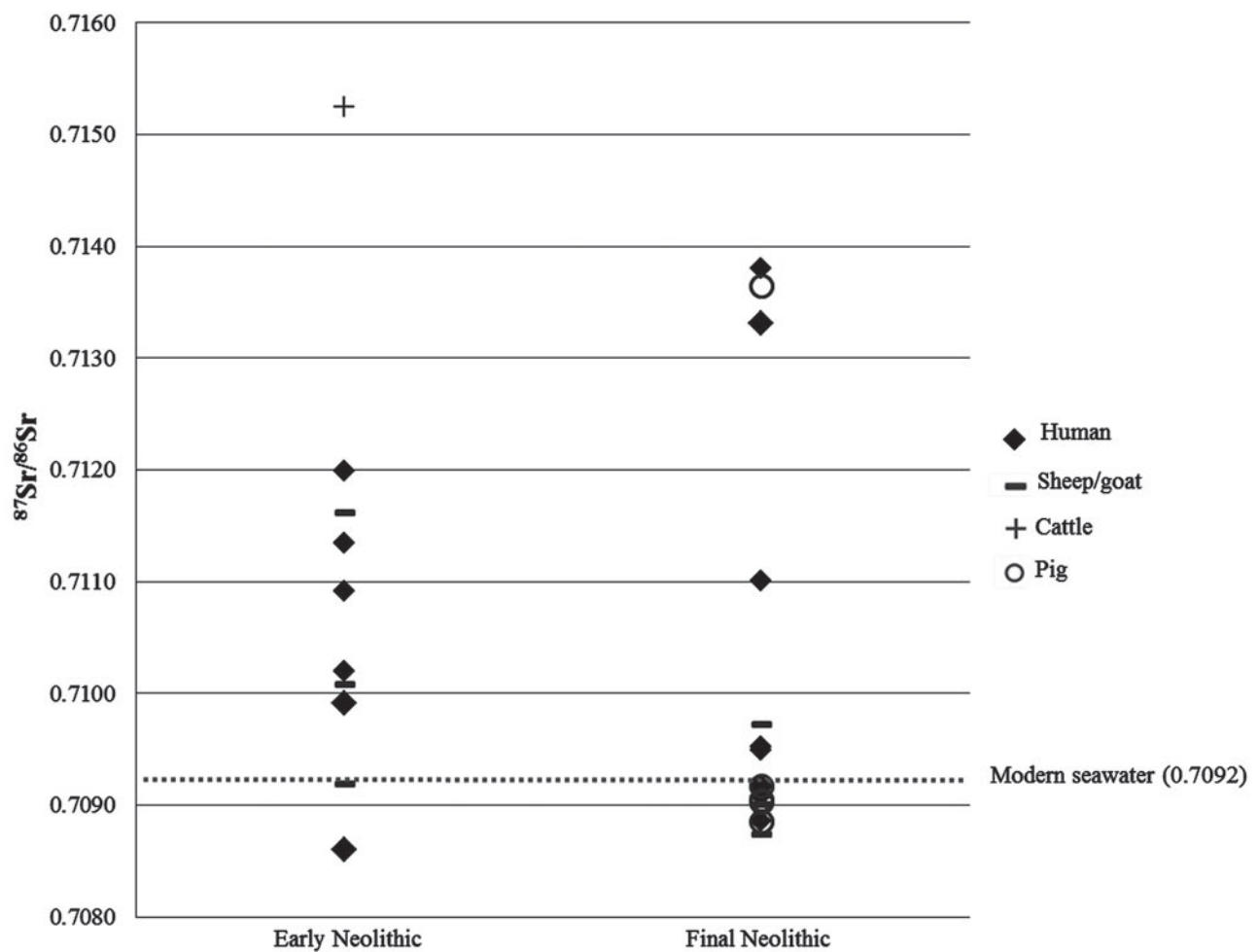


Figure 15.5. Radiogenic Sr isotope data for humans and fauna from Alepotrypa Cave. Samples are separated according to dated archaeological contexts Early and Final Neolithic.

(CAR-0021, 24, 25, 26, 34, 36), two individuals with some dental disease (calculus, cupped wear and maleruption of a canine) (CAR-0031, 38), and one individual with a metopic suture (CAR-0032) fall within the estimated local range. Almost all of the possible non-local individuals have evidence for some form of disease (CAR-0030, 33, 37), and in some cases the addition of non-metric traits (CAR-0022, 28, 35).

Finally, human and animal samples from securely dated contexts were organised according to their time period (Early and Final Neolithic; Figure 15.5). For the Early Neolithic, the human and sheep/goat samples match up with the estimated 'local' and Vardar geological regions. The most radiogenic sample in the study (CAR-0044) is from a cow tooth from Ossuary I (Early Neolithic). This data point is very different from the rest of the Early Neolithic samples, even though it comes from the same context (A/4/13 12-8-70) as the less radiogenic sheep/goat specimen (CAR-0041). Human and faunal samples from Final Neolithic contexts represent all three preliminary isotopic zones: the local region, the Vardar tectonic zone, and the highest radiogenic values (unknown

source). There appears to be a greater range of strontium isotope values for humans during the Final Neolithic time period, although the sample size is too small to draw any conclusions at this point.

Conclusions and thoughts for future research

The preliminary isotope results for humans and animals buried in Alepotrypa Cave during the Early and Final Neolithic are very intriguing. A majority of the human and animal data cluster around the value for modern seawater and are consistent with previously published 'biologically available' strontium isotope data for other archaeological sites located within the Gavrovo tectonic zone. Unfortunately these data also overlap with several other geological regions of the southern Aegean (Pelagonian, Ionian and the Attic-Cycladic metamorphic belt), which introduces a possible limitation to the interpretation of strontium isotope results from archaeological material in the Aegean. Despite this overlap, there are two clusters of more radiogenic isotope values, one that is consistent with samples from the Vardar zone, and another that does

not overlap with any previously published local data for the Aegean. Interestingly, the humans with the highest $^{87}\text{Sr}/^{86}\text{Sr}$ ratios (unknown geological source) date to the Final Neolithic period and also have the most osteological evidence for disease.

The isotopic variability of the humans and animals buried at Alepotrypa may indicate that the site was an important destination for Neolithic farmers throughout the Aegean. In order to evaluate whether high radiogenic strontium values indicate individuals of non-local origins, more thorough characterisation of isotope variability in both the local environment and the surrounding regions is needed. Future research will expand the sample of $^{87}\text{Sr}/^{86}\text{Sr}$ values for fauna and plants throughout the Mani peninsula. While some overlap in the strontium isotope values is reported for the Gavrovo zone, Pelagonian zone, Ionian zone and the Attic-Cycladic metamorphic belt, $\delta^{18}\text{O}$ data may help differentiate locals from individuals coming from these other regions. These data will be worked up from current and future samples. Further research will also identify possible sources of highly radiogenic biologically available strontium from both local and non-local geological contexts.

Bibliography

- Bentley, R. A. (2006) Strontium isotopes from the earth to the archaeological skeleton: a review. *Journal of Archaeological Method and Theory* 13, 135–187.
- Budd, P., Montgomery, J., Barreiro, B. and Thomas, R. G. (2000) Differential diagenesis of strontium in archaeological human dental tissues. *Applied Geochemistry* 15, 687–694.
- Faure, G. (1986) *Principles of Isotope Geology*. New York.
- Giblin, J. I. (2011) *Isotope Analysis on the Great Hungarian Plain: An Exploration of Mobility and Subsistence Strategies from the Neolithic to the Copper Age*. Unpublished PhD, Columbus, Ohio State University.
- Giblin, J. I., Knudson, K. J., Bereczki, Z., Pálfi, G. and Pap, I. (2013) Strontium isotope analysis and human mobility during the Neolithic and Copper Age: a case study from the Great Hungarian Plain. *Journal of Archaeological Science* 40, 227–239.
- Higgins, M. D. and Higgins, R. (1996) *A Geological Companion to Greece and the Aegean*. Ithaca.
- Hillson, S. (2005) *Teeth*. Cambridge.
- Kohn, M. J., Schoeninger, M. J. and Barker, W. W. (1999) Altered states: Effects of diagenesis on fossil tooth chemistry. *Geochimica et Cosmochimica Acta* 63, 2737–2747.
- McArthur, J. M., Howarth, R. J. and Bailey, T. R. (2001) Strontium isotope stratigraphy: LOWESS Version 3: best fit to the marine Sr-isotope curve for 0–509 Ma and accompanying look-up table for deriving numerical age. *Journal of Geology* 109, 155–170.
- Nafplioti, A. (2011) Tracing population mobility in the Aegean using isotope geochemistry: A first map of local biologically available $^{87}\text{Sr}/^{86}\text{Sr}$ signatures. *Journal of Archaeological Science* 38, 1560–1570.
- Papathanasiou, A. (2001) *A Bioarchaeological Analysis of Neolithic Alepotrypa Cave, Greece* (British Archaeological Report S961). Oxford.
- Papathanasiou, A. (2003) Stable isotope analysis in Neolithic Greece and possible implications on human health. *International Journal of Osteoarchaeology* 13, 314–324.
- Papathanasiou, A. (2005) Health status of the Neolithic population of Alepotrypa Cave, Greece. *American Journal of Physical Anthropology* 126, 377–390.
- Papathanasiou, A., Larsen, C. S. and Norr, L. (2000). Bioarchaeological inferences from a Neolithic ossuary from Alepotrypa Cave, Diros, Greece. *International Journal of Osteoarchaeology* 10, 210–228.
- Papathanassopoulos, G.A. (ed.) (1996) *Neolithic Culture in Greece*. Athens.
- Price, T. D., Burton, J. H. and Bentley, R. A. (2002) The characterization of biologically available strontium isotope ratios for the study of prehistoric migration. *Archaeometry* 44, 117–135.
- Richards, M., Harvati, K., Grimes, V., Smith, C., Smith, T., Hublin, J. J., Karkanas, P. and Panagopoulou, E. (2008) Strontium isotope evidence of Neanderthal mobility at the site of Lakonis, Greece using laser-ablation PIMMS. *Journal of Archaeological Science* 35, 1251–1256.

The plant remains from Alepotrypa Cave: use, discard and structured deposition

Evi Margaritis

Archaeobotanical studies in Greece have revolutionised our knowledge of domestication, environmental change, agricultural practices, diet, economy, and daily and social life. A variety of studies has tackled these issues from the Palaeolithic to the Roman period (for large targeted projects, see Jones 1983; Sarpaki 1987; Valamoti 2004; Megaloudi 2006; Margaritis 2006; Kotzamani 2013).

The best documented period for archaeobotanical remains is the Neolithic, at least in the area of Macedonia and Thrace, where most of the information comes from settlements of various types, not only tells and extended sites (Valamoti 2004), but also lake settlements (Margaritis 2011). Much data is also being accumulated piecemeal from different areas of Greece, but another targeted study on a regional level has not yet been undertaken. In addition, archaeobotanical research has also focused on cave sites such as Franchthi (Hansen 1991), the Cave of the Cyclops (Sarpaki 2011), Kitsos (Halstead and Jones 1987), Drakaina (Stratouli *et al.* 2014), Zas (Flint-Hamilton 1994), Skoteini (Mangafa 1993), Sarakenos (Megaloudi 2008), Theopetra (Kotzamani 2013), Schisto (Kotzamani 2013), and Sidirokastro¹ (Margaritis in preparation).

The material from Alepotrypa² comes as a very important addition, not only to the study of Neolithic cave sites, but also to the study of the Neolithic period of southern Greece, an area where archaeobotanical evidence from any period is comparatively scarce. In addition, the suggested ritual character of the cave, indicated by the human remains and the structured deposition of other types of material culture (pottery, ground and chipped stone tools, as well as the burning of dung) give a special value to the archaeobotanical remains found, which in turn add to the hitherto limited evidence of plant deposition related to burials and ritual activities during the Neolithic (Valamoti 2009; Valamoti *et al.* 2011; Margaritis 2014).

The purpose of this chapter is to: a) register the crop repertoire used in the cave; b) understand the taphonomic conditions and the circumstances under which the plant remains entered the archaeobotanical record; c) clarify crop processing sequences and the economic value of specific plants; and lastly d) to initiate a discussion on the deposition of food and plants beyond the domestic and to detect any possible differences between the ritual and the quotidian.

Material and methods

The archaeobotanical material under study was retrieved by water flotation, undertaken on site during the recent excavations, between 2011 and 2014.³ The flots were studied at the Wiener Laboratory of the ASCSA using a stereomicroscope for the identification of the species. The nomenclature used follows *Flora Europaea* (Tutin *et al.* 1964) and relevant plant atlases (Cappers *et al.* 2009). Sorting of the heavy residues was done on site and the samples were treated in their entirety. Samples, which were recovered under different conditions from previous excavation seasons, were also available from other areas of the cave.⁴ However, although those last were rich in charcoal remains (Ntinou this volume), no other plant remains were retrieved.

Location and finds

The material studied for this chapter comes from only two distinct areas of the cave, Chamber B Trench B1A (henceforth B1A), which is located close to the entrance of the cave, and Chamber D Thesi (Locus) 14 (henceforth Θ 14), located in the centre of the cave. The assemblage from area B1A is dated to the Final Neolithic, while Θ

14 is dated to the Late-Final Neolithic (for dating of the various areas and specific contexts of the site, see Papathanasiou, chapter 2 this volume).

The samples yielded 15 different species, including cereals, pulses, fruit trees and wild species (Table 16.1): *Cereals*: einkorn (*Triticum monococcum*, grains and chaff), emmer (*Triticum dicoccum*), spelt (*Triticum spelta*), free-threshing wheat (*Triticum aestivum/durum*), hulled barley (*Hordeum vulgare* hulled).

Grains that shared some of the main characteristics of specific species, but were not securely identified were recorded in 'cf' categories. Barley grains were identified as hulled straight or cf hulled, on the basis of their shape, but also on the visible traces of the hulls on the grain. None of the grains was identified as twisted, so the presence of a six-row variety cannot be confirmed (but also cannot be excluded: Zohary *et al.* 2011). Due to the poor preservation and fragmentation of some of the barely grains, they were mostly recorded as *Hordeum* sp.

Classification was complicated by the problematic distinction between einkorn and emmer, and between emmer and spelt. There is an overlap between spelt and emmer grains, multiplied by the effects of carbonisation and the fragmentation of the plant remains, but a distinction can often be made since the latter has a rounded and distinct dorsal ridge. Grains without a distinct rounded dorsal ridge were recorded as cf spelt, as they resembled more this species. Chaff remains (spikelet forks and glume bases) can be used to distinguish between einkorn, emmer and spelt in a more secure way. However, only one spikelet fork was found in the assemblage: it was identified as einkorn. It is not possible to distinguish the grains of free-threshing bread and macaroni wheat according to their morphology. The most admissible way of differentiating these two species is the morphological variation of their rachis internodes (Zohary *et al.* 2011), which were however absent throughout the assemblage. The free-threshing grains therefore were classified as bread/macaroni wheat.

The majority of the grains of the assemblage are fragmented which makes their identification more complicated, while in some cases their distortion made it possible to be identified only to a family level and they were recorded as Cereal indet.

Pulses: Grass pea (*Lathyrus sativus*), vetch/vetchling (*Vicia/Lathyrus*), common pea (*Pisum sativum*), lentil (*Lens* sp.); Legume indet. are the plant remains which cannot be identified further, but it is obvious that they are legumes.

Nuts and fruits: almond (*Prunus amygdalus*), fig (*Ficus carica*); Wild/weed: dandelion (*Lolium temulentum*), medic (*Medicago* sp.) and grass family (Gramineae). Organic matter with acellular structure was identified as amorphous plant material. In other cases such materials have been identified as parts of fruit matter from grapes (Margaritis and Jones 2006) or olive fruits (Margaritis and Jones 2008).

Chambers B and D

Trench B1A is the extension of area B1 in Chamber B, located close to the entrance of the cave. As already noted, the samples recovered from this area and presented here are dated to the Final Neolithic period, though area B has revealed earlier phases in the Alepotrypa chronological sequence too. The samples come from depths ranging from the surface of the trench down to 0.50 m and from different subunits of the trench. As presented in Table 16.1, most of the samples are of mixed composition; in some of them the majority of the species present in the whole assemblage are represented.

Some observations can be made regarding the use of specific plants in the cave. Cereals form the most important group of species, but over the complete spectrum they are represented in only small quantities. Barley occurs in the majority of the samples, and in some is the only cereal present. Although in some grains traces of hulls are visible, the actual hulls are missing from the grains. The next commonest cereal present in many cases is einkorn, both as grains and as a single spikelet fork, the only chaff from the whole assemblage. Emmer is also present in few samples, while free-threshing wheat and spelt are represented only by few grains. It should be noted again that the identification of the very last is only tentative. Pulses, although limited in numbers, come in three different species, though it is possible that further species are present in the legume indet. category. Grass pea exists as both complete specimens and in halves, and in this latter case the outer coat of the seed is missing. Fig remains are very scarce, while almond shells occur only in few samples. The same situation applies to the wild/weed category: they could be present as weeds of cultivation, accompanying cereals and pulses, but they could also have been gathered intentionally or even have been part of the natural vegetation around the site. The categories cereal indet. and legume indet. are also present in some samples, confirming the state of preservation of the assemblage.

It is difficult to evaluate the importance of specific species, let alone the preferences of the people using the cave, due partly to the limited quantities of material, but also because of their fragmentary state, which biases the identification. Fragmentation and bad preservation of archaeobotanical material can be the result of several formation processes, including intensity of charring and crop processing, as well as from post-depositional processes. Post-depositional processes include the destruction of already deposited material through erosion, trampling *etc.*, and alterations in water levels: all such alter the preservation of material in the soils. These agents can, however, be potentially detected in archaeobotanical assemblages comprising large quantities of material. Such has been attempted in case studies where numerous cereal grains were available (Antolin and Buxo 2011). In the

the cereals present are barley, free-threshing wheat and einkorn, though the majority of the archaeobotanical material here consists of pulses (Cappers and Mulder 2004). Information indicating a variety of agricultural practices also comes from the sites of Aspis (Margaritis 2014), Ag. Vasileios (Karathanou and Valamoti 2013), Mycenae (Hillman 2011; Margaritis under study),⁵ Midea (Margaritis *et al.* 2014), Tiryns (Margaritis in Veters *et al.* 2016) and Mygdalia in Achaia (Margaritis under study).⁶

Disentangling the plant assemblage: crop processing and taphonomic conditions

Crop processing consists of *pre-depositional processes*: these characterise the husbandry practices applied to crops in the field, and the processing sequence to which crops are subjected to after harvest, right up to the stage when they are used as food, fodder, fuel *etc.* This would also include their possible transformation before consumption (Jones 1983, 4), such as through grinding for cereals and legumes, pressing grapes for the production of wine or crushing olives for the production of olive oil. As ‘crop processing is ... a filter operating between crop cultivation and utilisation’ (Jones 1983), crop processing prevents parts of some plants involved in agricultural practices from reaching the archaeological site. Cereals, for example, are processed in a specific logical order: winnowing, for example, cannot precede threshing, and sieving cannot precede winnowing. Thus the early stages of crop processing may remove parts of cereals and legumes, subsequently left in the fields (Hillman 1981, 1984a, 1984b).

Here, contemporary but non-mechanised agricultural systems employed today are relevant for the understanding

[illegible]

of agricultural systems of the past. Ethnographic studies targeted to the understanding of the composition of archaeobotanical assemblages have suggested that cereal remains can be potentially assigned to various crop-processing stages, based on the relative proportions of grain, chaff and weed seeds (Hillman 1981, 1984a, 1984b; Jones 1983, 1984). The crop-processing approach aids the identification of different activities within a site (Jones 1987) and facilitates the interpretation of specific rooms and buildings (Jones 1984). For instance, dehusked grain points towards a product prepared for human consumption and burnt chaff indicates its use as fuel (Valamoti 2004). The chaff of glume wheat would not necessarily be removed from a product, if the grain were not intended for human consumption (Nesbitt and Samuel 1996).

Free-threshing cereals are those where the threshing process easily releases the grain from the ear – the ear immediately breaks into grain, awn fragments and rachis segments. Hulled cereals need a supplementary process of dehusking, in order to free the grain from the hull (in the case of barley) or from whole spikelets (in the case of glume wheats). On the basis of the discussion on crop processing and taphonomy presented in the previous section, I will attempt to reconstruct what these plant remains ‘mean’, which specific human actions they represent and how they ended up in the matrix of Alepotrypa Cave.

In general, plants were put to a variety of uses at any site: they served not only for human consumption, but also as fodder, fuel, in dyeing, for medical and ornamental purposes, and for construction material, bedding, thatching and wickerwork. Some of these uses are attested in the cave on the basis of the phytolith data (Tsartsidou, this volume). In these cases, the plants were brought intentionally to the site by its occupants, but in other instances plant remains may have entered the settlement embedded in animal dung.

The optimal situation in the case of the last is for the dung to be recovered in the form of complete (goat or sheep) pellets. However, components of dung can also be found as part of dung-cakes used as fuel. The cereal grains, chaff and weed seeds are identifiable after passing through the digestive system of the livestock (Miller 1984; Charles 1998). Dung has been acknowledged as an alternative source for the presence of plant remains at early sites in Northern Greece (Valamoti 2004). At the site of Mandalo, the potential identification of dung was based on the composition of specific samples that were rich in chaff and weed seeds. It is suggested that the latter plant remains did not reach the sites through any crop processing sequence, but originated from a separate source (Valamoti and Jones 2003). Tsartsidou (this volume) has argued that large quantities of dung were being burnt in Chamber Z. Both phytolith (Tsartsidou this volume) and micromorphological (Karkanis this volume) analyses have testified to the presence of dung

in different areas of the cave, but mainly in its interior in Chamber Z. However, the archaeobotanical material here being reviewed does not suggest the local presence of dung: too little of both chaff and weed seeds have been found in the assemblage, while the weeds present could easily be those of cultivation. This limited quantity does not give opportunity for advancing the discussion much further on this front.

Regarding preservation, experiments have shown that this is likely to have been biased: certain botanical components are preferentially open to damage because of their physical nature (Boardman and Jones 1990; Viklund 1998; Margaritis and Jones 2006, 2008). This bias favours the preservation of more robust items, such as cereal grains, grass caryopses and pulses, with poorer (or no) preservation of fragile associated elements (*e.g.*, chaff, pulse pods, *etc.*).

In addition, different agricultural procedures are employed in dry and wet environments to achieve the same ends. In dry environments, most of the activities are carried out in open areas and in large quantities, while in moister environments, activities are done piecemeal and on a day-by-day basis. Glume-wheat grains stored in their spikelets may be less susceptible to various hazards such as fungus, moisture, insect and rodent damage, although this has not been demonstrated conclusively (Sigaut 1988). This type of storage tradition has been suggested at several excavations in Greece, such as Assiros (Jones *et al.* 1986), Thermi (Valamoti 1992) and Dispilio (Mangafa 2002; Margaritis 2011).

When considering how crop processing strategies affected charred assemblages, it should be noted that the processing sequence can be divided into two groups of activities: those that are undertaken before storage and those that are conducted when stored crops are then taken from storage for further processing and consumption (Hillman 1981, 1984a). Those tasks occurring prior to storage are usually conducted in bulk at harvest time, once or twice a year (depending on the local circumstances). Because of the limited number of times such activities occur within a single year, the waste from them may only be present for a limited and specific period of time. These processing activities stand in marked contrast to those activities carried out when a crop is removed from storage. Such events are conducted regularly throughout the year, usually within settlements and so in proximity to fires (Fuller *et al.* 2014).

Moreover, crop processing stages can also be distinguished using weed seed characteristics. Here, the size and nature of the seed is relevant to the type of sieving process employed: the tendency of some weed seeds to remain in their seed heads, spikes or clusters, despite threshing, is relevant when coarse sieving is being carried out. These tend to be retained in the sieve, while free and small seeds pass through (Jones 1992; van der Veen 1992). By-products from the early stages of the

processing of cereals, such as winnowing and coarse sieving, can be separated from the other products and by-products that occur in the later stages of the procedure (Jones 1992). As the harvested crop progresses through the processing sequence, larger proportions of edible grain are retained relative to waste (mainly chaff and weed seeds). In addition, any remaining weed seeds will be closer in size and weight to the cereal grains: large seeds will be preferentially present, relative to small ones (Jones 1987; Stevens 2003a).

For the interpretation of the material it is important to try to reconstruct those depositional processes by which it became first charred and then deposited in the archaeological matrix. There is not, in most cases, a direct relationship between the activities that created an archaeobotanical assemblage and the excavated context from which it was recovered. Those that do include the way plant remains are preserved by charring⁷ in connection with accidental fires or intentionally when the plant material is used for fuel.

The ‘critical variables’ that structure these activities (La Motta and Schiffer 1999) are to be found in the relationships of plant structure, in edible versus inedible plants, and the impact of charring on various plant parts, which are determined by the characteristics of plants and thus transcend cultural variation (Fuller *et al.* 2014).

Discussion

Despite the limited number of plant remains found at Alepotrypa Cave, the variety is substantial: four⁸ cereals, three⁹ legumes, as well as fruits, nuts and weeds are present.

As noted, it is hard to differentiate and choose between their various potential intentional uses. Do cereal by-products get used as fodder or fuel? Do wild plants represent by-products, elements of dung, or were they deliberately collected for human use (*e.g.*, as famine food, medicines, flavourings, or all of these)?

It is the content of the assemblages themselves that is most informative about past human activities (Fuller *et al.* 2014). The same species are routinely being burnt, after being produced by a limited number of well-defined activities: these activities are being repeated on a continuous basis. In B1A, the plant remains certainly do not represent stored material: they are not only very low in quantity, but also very mixed in character. So the most important source of seeds and chaff will have been the routine, daily activities of final crop processing for food preparation, in which crops, and their contaminants, are taken from storage and processed towards consumption (Stevens 2003b). The waste and incidental loss of crop that resulted from these activities are then disposed of in the fire, whether as intentional fuel or rubbish disposal. In B1A, charred assemblages are not related to one particular event or activity, but signify something that is essentially

tertiary or at best secondary refuse, reflecting average and recurrent patterns of activity. The same situation applies to Θ 14, as it is not possible to know how many depositional episodes the plant remains represent.

Both glume wheats and hulled barley have been dehusked. Their chaff and hulls have been removed and the crops have already been subjected to sieving; they thus represent the end of the crop processing sequence. The presence of chaff in the form of a single spikelet form of einkorn in B1A could represent insufficient dehussing and the subsequent release of the chaff due to carbonisation. The presence of weeds of relatively large size in the assemblage in both areas of the cave is indicative of hand sorting, a stage of crop processing undergone before consumption of cereals and pulses. The presence of those by-products, found together with mixed material of cereals and pulses, could indicate that they were part of the assemblage before their removal for consumption, and were burnt or deposited together (see below). At the same time, they could also indicate by-products of the final stage of crop processing, which ended up in the fire of the cave as fuel. The crop processing most likely was undertaken outside the cave or closer to the entrance and so to the light; then the by-products were subsequently used as fuel. The fragmentation of the cereal grains could have been the result of threshing and dehussing processes, done prior to charring (for dehussing, see Alonso *et al.* 2013). It has been suggested that barley was not used by the Neolithic farmers as much as were the glume wheats, at least in northern part of Greece: this preference could be due to ‘cultural’ preference, and the particular local requirements of subsistence (Valamoti 2004). The situation at Alepotrypa does not indicate that there was a preference for glume wheats, although indeed the material is not numerous. Especially at Θ 14, barley is more numerous than the glume wheats. Similarly, the limited representation of free-threshing wheat in the archaeobotanical record reflects a choice made by the Neolithic farmers to cultivate this crop on a very limited scale or omit it completely from their crop repertoire. The latter is possible as it has also been suggested that in the Neolithic this variety was merely a contaminant of glume wheats, although the evidence from Makri and Arkadikos does indicate that it was grown on its own right (Valamoti 2004). The preference for glume wheats could result from their better resistance than free-threshing wheat to bird, insect and fungal attack, as well as to humidity (Sigaut 1988). Both einkorn and emmer are very hardy species, but emmer has a preference for warm dry plains (Christidis 1963). Barley is a very resistant species that can tolerate poor and dry soils, as well as some salinity, and this made the species well adapted to the climatic conditions of the Aegean.

Although there is evidence for storage vessels in the cave (see Valvis, this volume), it is difficult to imagine that crops would have survived any long-term storage,

due to the excessive humidity of the cave. Sprouting of grains and germination have been recorded in caves in southern France due to such humidity (Bouby *et al.* 2005). It has also been suggested that free-threshing cereals are protected by a multi-layered epidermis and so can be stored for a longer period without chaff (Meurers-Balke and Luning 1992). Essentially, storage can only be confirmed by the pottery record. The lack of a good storage environment could point to an occasional and temporary use, for foodstuffs of immediate necessity.

Legumes are also present in several samples. The presence of the grass pea is of interest, as it needs further treatment if it is to be consumed by humans. Today, grass pea is a minor pulse crop, mainly produced in India and to lesser extent in southwest Asia and Ethiopia. In these areas grass pea is produced as animal-fodder, although poor people still eat it (Cappers and Mulder 2004). Its status as food or fodder has been challenged due to its toxicity, although most likely it was used for human consumption (Valamoti 2004; Margaritis 2011). There are several ways to detoxify the grass pea: soaking, roasting, parboiling and boiling all reduce the toxic content to different degrees, although these same processes also reduce the nutritional value of the seeds (Cappers and Mulder 2004).

In Chamber D, it seems that plant remains are present in every burnt horizon, which alternated with clay horizons (Karkanas, this volume). As suggested, no significant difference exists between the two assemblages, apart from the better preservation of the material in the Chamber: this is apparent mainly with the barley grains, which are the most numerous find of the assemblage. In both areas of the cave, human remains have been found: the presence of burials, in situ or not, gives a special character to any assemblage in the cave. The animal remains suggest periodic use of the cave, but the material does not have any very special character, containing nothing unknown to the run of domestic assemblages of the Neolithic (Hadjikoumis, this volume). The phytolith assemblage similarly does not include unexpected species; it does not indicate crop processing in the cave. In the interior of the cave, the large quantities of dung, in an area which could not be used for habitation or animal penning, has been interpreted as present as part of a ritual activity (Tsartsidou, this volume). Further, the species present in the wood remains are not in any way special, nor do they indicate any great differences between most areas of the cave. Only in Chamber Z can the presence of black pine, a species that originates from a different area of the Peloponnese, be perceived as unusual. In this part of the cave, specific types of fuel were used, lighter and easy to carry than larger wood logs used in the remote area of the cave, burnt together with dung (Ntinou, this volume). The chipped lithic material also suggests the deposition of unused tools (Kourtessi-Philippaki, this volume). Stroulia (this volume) has suggested that the Alepotrypa ground stone tools seem to make up a domestic tool kit, most

likely utilised in mundane way at the end of their lives: their use was marked by their deposition in non-mundane contexts, accompanying the human burials.

Although, as suggested, there is no difference in the composition of the assemblage from the two different areas of the caves, the much better preservation of the material from Chamber D could indicate that they were not just thrown into the fires of Θ 14, but they were rather deposited within a vessel, or were placed at the periphery of the fires.

The possibility that plant deposition was a deliberate act needs to be considered. The symbolic context of food in funerary contexts is well known; and a ritual context is already assured at Dirou. Plant remains have been shown to be grave goods (Palmer and van der Veen 2002); variations in the presence of native versus imported plants have been the focus in exploring possible differences in identity, gender and status (Petrucci-Bavaud *et al.* 2000).

Relevant case studies from Greece amount only to a handful of examples, though most, fortunately, come from the Neolithic. The site of Mavropigi, located in Macedonia, has revealed a large quantity of glume wheat deliberately deposited around the skeletons in two early Neolithic graves, possibly as an offering within the context of the burial ritual (Valamoti 2009). Grass-pea concentrations were found at the late Neolithic site of Kremasti, also in Macedonia, in pits associated with animal and human burials, and also alongside the intentional burial of 'special' objects. These finds of legumes have been interpreted as ritual offerings made at certain occasions in the lifecycle of the people or the settlement, when 'pulses were ritually consumed in the form of burnt, buried seeds' (Valamoti *et al.* 2011). The site of Avgi is located in the northwest part of Greece. Within the habitation area and between two buildings, several miniature vessels were excavated, two of which contained the cremated cranial bones of an adult and an infant, dated to the early 5th millennium (Stratouli *et al.* 2010). The bones were placed in the bottom of the vessels, and the rest was full of charred seeds. The hundreds of well-preserved seeds found in the vessels were identified as lentils, a crop that has been extensively recovered elsewhere within the domestic areas of the site (Margaritis 2014). Examples from the Bronze Age are known from the sites of Petras, Aspis and Kirrha, all connected with burials (Margaritis 2014). The Late Bronze Age chamber tombs at Ayia Sotira in the Peloponnese revealed limited quantities of plant remains, such as cereal grains, glume wheat chaff, legumes and fruits, in the dromoi and the chambers of the tombs; these have been tentatively interpreted as evidence of the possible preparation, consumption, or offering of food (Smith *et al.* 2014).

Plant deposition has been lately the focus of research beyond burials, including offerings made at altars, in temples and on sacrificial domestic pyres: this extends the research focus beyond the prehistoric era (Margaritis

2015). In this set of contexts, there is no clear evidence that specific species or 'exotic' plants were *especially* connected with the ritual activities; no certain patterns have been revealed. All the species present are also found in domestic contexts and everyday ones. The boundary therefore between ritual and domestic when it comes to deposition of plant remains is not species dependent. Any identification of ritual deposition is rather a matter of context than revealed by the assemblage composition. If their context had been unknown, nothing would have indicated a use other than the domestic. Such finds could represent part of the daily life, be connected to the harvest or the by-production of some agricultural practice. It has also been suggested that the deposition of food, particularly in or at burials, could represent the conceptual presence of the domestic hearth, where the core of the household's cooking activities took place. Such an identification creates a link between the everyday domestic routines with those in another world, blurring the lines between ritual and domestic action.

It has further been suggested that even when the contexts do provide evidence of specialised activity, they yet contain all the categories of materials and artefacts associated with daily life. Specific elements of domestic life have thus been ritualised, with similar assemblages appearing in contexts of both ritual and domestic character and in structured deposits (Bradley 2003; Tomkins 2009). It is vital to investigate the formation of the archaeological record, for without some understanding of how particular deposits were created, their interpretation remains problematic. In the current case, we must also ask how the plant remains became charred and were deposited. The domestic model of cave occupation in the prehistoric Aegean has also been questioned by Tomkins (2009, 2012); he points out that a clear boundary between ritual and the everyday does not exist. A range of structured depositions and manipulation of material indicative of ritual behaviour has been recorded, acts that include fragmentation and accumulation. These draw upon and simultaneously transform matters domestic, so linking people and places across time and space. Ritual can thus be a different way of interpreting and experiencing the domestic (Tomkins 2009), expressed by the deliberate deposition of food in specific contexts.

The plant remains, accordingly, found in both ritual and domestic contexts are not different, at least on the basis of the assemblages available thus far. This is not surprising, as food production, distribution and consumption were, and still are, central to the maintenance of social relationships. While these aspects have been addressed through the study of animal bones from certain restricted contexts, this same approach offers the opportunity to look at food across a broader field of social activities. Food is considered a dynamic component in a wide range of social relations in private and public situations; it may express identity in many types of social and economic relations (Hamilakis

1998; Hamilakis and Konsolaki 2004; Isaakidou and Halstead 2013). The same foods can be employed on a number of levels: from daily consumption to special events marking particular occasions or rites of passage (Palmer and van der Veen 2002). When incorporated in mortuary practices, eating and drinking have a mnemonic power, and the emotions and senses stimulated by food are combined with those generated by the heightened experiences of death and burial. It should be pointed out that in the case of plant deposition in the cave of Alepotrypa, food is not involved, as the vegetal material has been transformed through charring.

The key element here is the use of fire. The charred seeds could be a symbolic mode of reference to the process of transformation: any kind of rite of passage includes some kind of transformation. The plant remains in the contexts mentioned here have in common the deliberate act of transformation and consumption occasioned by burning.

It is beyond any doubt that if the plant remains had been deposited raw, they would not have survived. The important factor here then is not simply the deposition of plant material, but the deposition of *charred* plant material (Margaritis 2014). The plant remains under discussion here can therefore be seen as a case of deliberate transformation of material accompanying the dead or marking particular rituals, where the charring of the seeds did not aim at their complete destruction, but rather at their preservation through fire.

The crucial point here is that what is actually deposited is the domestic transformed, through fire, fragmented and destroyed. This connection with fire has an obvious parallel with the rites of cremation, a complex composite act resulting in the transformation and consumption of the body through fire. One aspect of the deposition of burnt seeds and fruits in the grave is for it to act as a metaphor for transformation: the deliberate act of transformation and consumption by burning. Fire does not merely transform its fuel, but has a key role in effecting major changes in basic aspects of life: cooking food, creating agricultural land, firing pots, or the making and shaping of metals. The role of fire in destroying (or changing the state of) artefacts has been noted since the Upper Palaeolithic. A characteristic example is the destruction of axes in Neolithic Scandinavia, not utterly but in a way that preserves them in lumps as large as possible, even after their fragmentation by fire (Larsson 2004).

At Alepotrypa the role of fire and transformation is also highlighted through probable acts of dung burning. This last should not only be approached as mere refuse disposal, but its burning can be understood as the symbolic manipulation of matter, in which the dung is transformed to a new subsistence, white ash (Mlekuz 2012). This transformation by burning takes some time and is the result of everyday routines, and hence a cultural construct (Mlekuz 2012). As dung is an animal product,

its manipulation, burning and deposition could be seen as an important part in maintaining relations between people and animals, places and landscape (Mlekuz 2012).

In a similar way, the burnt seeds, the sacrificed plants, remain preserved though fire, and can so act as a token of memory for specific rites of passage, connecting the dead with the everyday, connecting the agricultural land outside with specific actions taking place inside Alepotrypa Cave. What is deposited in the cave are parts of outside activities: food production, fuel use, animal husbandry, pottery consumption – even burials too, like those found very close by the cave at the site of Ksagounaki. Alepotrypa Cave acts like a container, for materials, animals, plants, people (dead and alive), separating them from the landscape and the world outside the cave. These two worlds though are very similar in their physical expressions, and so challenge us to appreciate the dichotomies that exist between the mundane and the ritual, that is to say – the sacred.

Notes

- 1 Large quantities of hulled barley have been found, suggesting a possible storage area in the cave.
- 2 I would like to thank the directors of the Alepotrypa excavation project and editors of this volume for entrusting me with the study of the archaeobotanical material; the work was undertaken in the Wiener Laboratory of the American School of Classical Studies at Athens.
- 3 A huge thanks is owed to Katerina Rangou and Roza Beshara for processing the soil samples and also for doing an outstanding job of the sorting of the heavy residues.
- 4 Sarpaki has studied a few samples from previous excavation seasons, but no contextual information is available and therefore it is very difficult to take this discussion further.
- 5 Evidence of glume wheat, hulled barley, lentil, olive and grape has been found at houses of the lower town.
- 6 Hulled barley, emmer, lentils and almonds were present in the assemblage deriving from the floor of a Mycenaean house.
- 7 Charring is the most common way of preservation of plant material in Greece.
- 8 Five, if we include the tentative identification of spelt wheat.
- 9 With the possibility of more, as the Legume indet. category might include more species.

Bibliography

- Alonso, N., Antolín, D., López, D., Cantero, F. J. and Prats, G. (2013) The effect of dehusking on cereals: experimentation for archaeobotanical comparison. In P. C. Anderson, C. Cheval and A. Durand (eds) *Regards croisés sur les outils liés au travail des végétaux*, 155–168. (XXXIIIe rencontres internationales d'archéologie et d'histoire d'Antibes). Antibes.
- Antolin, F. and Buxo, R. (2011) Proposal for the systematic description and taphonomic study of carbonised cereal grain assemblages: a case study of an early Neolithic funerary context in the cave of Can Sadurni (Begues, Barcelona province, Spain). *Vegetation History and Archaeobotany* 20, 53–66.
- Boardman, S. and Jones, G. (1990) Experiments on the effects of charring on cereal plant components. *Journal of Archaeological Science* 17, 1–11.
- Bouby, L., Fages, G. and Treffort, J. M. (2005) Food storage in two Late Bronze Age caves of Southern France: palaeoethnobotanical and social implications. *Vegetation History and Archaeobotany* 14, 313–328.
- Bradley, R. (2003) A life less ordinary: the ritualization of the domestic sphere in later prehistoric Europe. *Cambridge Archaeological Journal* 13, 5–23.
- Cappers, R. T. J., Neef, R. and Bekker, R.M. (2009) *Digital Atlas of Economic Plants*. Groningen.
- Cappers, R. T. L. and Mulder, S. A. (2004) Early Helladic grass pea (*Lathyrus sativus* L.) in Geraki. *Pharos X* (2002), 25–33.
- Charles, M. (1998) Fodder from dung: the recognition and interpretation of dung-derived plant material from archaeological sites. In M. Charles, P. Halstead and G. Jones (eds) *Fodder: Archaeological, Historical and Ethnographic Studies*. *Environmental Archaeology* 1, 111–122.
- Christidis, V. (1963) *Χειμωνιάτικα σιτηρά*, Thessaloniki.
- Flint-Hamilton, K. (1994) *Palaethnobotany of the Zas Cave on Naxos*. PhD dissertation. Duke University.
- Fuller, D. Q., Stevens, C. and McClatchie, M. (2014) Routine activities, tertiary refuse and labour organisation: social inferences from everyday archaeobotany. In M. Madella, C. Lancelotti and M. Savard (eds) *Ancient Plants and People. Contemporary Trends in Archaeobotany*, 174–217. Tuscon.
- Halstead, P. (1994) The north–south divide: regional paths to complexity in prehistoric Greece. In C. Mathers and S. Stoddart (eds) *Development and Decline in the Mediterranean Bronze Age*, 195–219. (Sheffield Archaeological Monographs 8). Sheffield.
- Halstead, P. and Jones, G. E. M. (1987) Bioarchaeological remains from Kalythies Cave, Rhodes. In A. Sampson (ed.) *Η νεολιθική περίοδος στα Δωδεκάνησα*, 135–152. Athens.
- Hamilakis, Y. (1998) Eating the dead: mortuary feasting and the politics of memory in the Aegean Bronze Age. In K. Branigan (ed.) *Cemetery and Society in the Aegean Bronze Age Societies*, 115–132. (Sheffield Studies in Aegean Archaeology 1). Sheffield.
- Hamilakis, Y. and Konsolaki, E. (2004) Pigs for the gods: burnt animal sacrifices as embodied rituals at a Mycenaean sanctuary. *Oxford Journal of Archaeology* 23, 135–151.
- Hansen, J. (1991) *The Palaeoethnobotany of Franchthi Cave*. (Excavations at Franchthi Cave, Greece, fascicle 7). Bloomington.
- Hillman, G. C. (1981) Reconstructing crop husbandry practices from charred remains of crops. In R. Mercer (ed.) *Farming Practice in British Prehistory*, 123–162. Edinburgh.
- Hillman, G. C. (1984a) Interpretation of archaeological plant remains: the application of ethnographic models from Turkey. In W. van Zeist and W. A. Casparie (eds) *Plants and Ancient Man, Studies in Palaeoethnobotany, Proceedings of the Sixth Symposium of the International Work Group for Palaeoethnobotany, Groningen, 30 May–3 June 1983*, 1–42. Rotterdam.
- Hillman, G. C. (1984b) Traditional husbandry and processing of archaic cereals in recent times, the operations, products, and equipment which might feature in Sumerian texts, part I:

- the glume wheats, Part I. *Bulletin on Sumerian Agriculture* 1, 114–152.
- Hillman, G. C. (2011) The grain from the Granary. In E. B. French (ed.) with contributions by G. Hillman and S. Sherratt *The Post-Palatial Levels*, 748–781. (Well Built Mycenae, 16/17). Oxford.
- Jones, G. E. M. (1983) *The Use of Ethnographic and Ecological Models in the Interpretation of Archaeological Plant Remains: Case Studies from Greece*. Unpublished PhD thesis, University of Cambridge.
- Jones, G. E. M. (1984) Interpretation of archaeological plant remains: The application of ethnographic models from Greece. In W. van Zeist and W. A. Casparie (eds) *Plants and Ancient Man, Studies in Palaeoethnobotany, Proceedings of the Sixth Symposium of the International Work Group for Palaeoethnobotany, Groningen, 30 May–3 June 1983*, 43–61. Rotterdam.
- Jones, G. E. M. (1987) A statistical approach to the archaeological identification of crop processing. *Journal of Archaeological Science* 14, 311–323.
- Jones, G. E. M. (1992) Weed phytosociology and crop husbandry: identifying a contrast between ancient and modern practice. *Review of Palaeobotany and Palynology* 73, 133–143.
- Jones, G. E. M., Wardle, K., Halstead, P. and Wardle, D. (1986) Crop storage at Assiros. *Scientific American* 254, 84–91.
- Isaakidou, V. and Halstead, P. (2013) Bones and the body politic? A diachronic analysis of structured deposition in the Neolithic-Early Iron Age Aegean. In G. Ekroth and J. Wallensten (eds) *Bones, Behaviour and Belief. The Zooarchaeological Evidence as a Source for Ritual Practice in Ancient Greece and Beyond*, 87–99. (Acta Instituti a Atheniensis regni sueciae, Series in 4, 55). Stockholm.
- Karathanou, A. and Valamoti, S. M. (2013) Plant remains from Ayios Vasileios, a Mycenaean settlement near Sparta: preliminary results. *Unpublished poster presented at the International Work Group for Palaeoethnobotany, 17–22 June, Thessaloniki*.
- Kotzamani, G. (2013) *Από τη συλλογή στην καλλιέργεια: αρχαιοβοτανική διερεύνηση των πρώιμων σταδίων εκμετάλλευσης των φυτών και της αρχής της γεωργίας στον ελληνικό χώρο (σπήλαιο Θεόπετρας, σπήλαιο Σχιστού, Σιδάρι, Πεβένια)*. Unpublished PhD thesis. University of Thessaloniki.
- La Motta, V. F. M. and Schiffer, M. B. (1999) Formation processes of house floor assemblages. In M. Allison (ed.) *The Archaeology of Household Activities*, 19–29. London.
- Larsson, L. (2004) Axeheads and fire: the transformation of wealth. In A. E. Walker, F. Wenban Smith and F. Healy (eds) *Lithics in Action*, 197–205. Oxford.
- Mangafa, M. (1993) Η αρχαιοβοτανική μελέτη του σπηλαίου Σκοτεινής στα Θαρρούνια Ευβοίας. In A. Sampson (ed.) *Skoteini Tharrounia: the Cave, the Settlement and the Cemetery*, 360–369. Athens.
- Mangafa, M. (2002) Η αρχαιοβοτανική μελέτη του οικισμού. In G. Hourmouziadis (ed.) *Δισπηλιό: 7500 χρόνια μετά*, 115–134. Thessaloniki.
- Margaritis, E. (2006) *The Olive and the Vine in Hellenistic Pieria. Archaeobotanical Case Studies from Macedonia, Greece*. Unpublished PhD thesis, University of Cambridge.
- Margaritis, E. (2011) Storage, lathyrism and gathering in the Neolithic Dispilio. *Anaskamma* 5, 76–88.
- Margaritis, E. (2014) Acts of destruction and acts of preservation. Plants in ritual landscape of prehistoric Greece. In G. Touchais, R. Laffineur, F. Rougemont, H. Prokopiou and S. Andreou (eds) *PHYSIS. L'environnement naturel et la relation homme-milieu dans le monde égéen protohistorique. Actes de la 14e Rencontre Égéenne Internationale, Paris, Institut National d'Histoire de l'Art, 11–14 Décembre 2012*, 279–286. (Aegaeum 37). Leuven-Liège.
- Margaritis, E. (2015) Beyond the domestic: food and plant use in Temples, Altars and Funerary Pyres. *Paper presented in Beyond the Polis. Ritual practices and the construction of social identity in early Greece (12th–6th century B.C.). Conference organised by A. Tsingarida and E. Lemos, Brussels, 24–26 September 2015*.
- Margaritis, E. and Jones, M. K. (2006) Beyond cereals: crop-processing and *Vitis vinifera* L. Ethnography, experiment and charred grape remains from Hellenistic Greece. *Journal of Archaeological Science* 33, 784–805.
- Margaritis, E. and Jones, M. K. (2008) Crop-processing of *Olea europaea* L.: an experimental approach for the interpretation of archaeobotanical olive remains. *Vegetation History and Archaeobotany* 33, 381–392.
- Margaritis, E., Demakopoulou, K. and Schallin, A.-L. (2014) The archaeobotanical samples from Midea: agricultural choices in the Mycenaean Argolid. In G. Touchais, R. Laffineur, F. Rougemont, H. Prokopiou and S. Andreou (eds) *PHYSIS. L'environnement naturel et la relation homme-milieu dans le monde égéen protohistorique. Actes de la 14e Rencontre Égéenne Internationale, Paris, Institut National d'Histoire de l'Art, 11–14 Décembre 2012*, 271–276. (Aegaeum 37). Leuven-Liège.
- Megaloudi, F. (2006) *Plants and Diet in Greece from Neolithic to Classic Period: The Archaeobotanical Remains*. (British Archaeological Reports S1516). Oxford.
- Megaloudi, F. (2008) Sarakenos Cave: archaeobotanical remains from the LN levels. In A. Sampson (ed.) *The Sarakenos Cave at Akraephion, Boeotia, Greece: the Neolithic and the Bronze Age: Pottery Analysis, Cave Occupation Patterns and Populations Movements in Central and Southern Greece. V. 1. The Research from 1994–2000*, 424–428. Athens.
- Meurers-Balke, J. and Lunin, J. (1992) Some aspects and experiments concerning the processing of glume wheats. In P. C. Anderson (ed.) *Prehistorie de l'agriculture: nouvelles approches experimentales et ethnographiques*, 341–362. (CNRS, Monographie du CRA n6). Paris.
- Miller, N. F. (1984) The use of dung as fuel: an ethnographic example and an archaeological application. *Palaeorient* 10, 71–79.
- Mlekuz, D. (2012) Notes from the underground: caves and people in the Mesolithic and Neolithic Karst. In K. A. Bergsvik and R. Skeates (eds) *Caves in Context. The Cultural Significance of Caves and Rock Shelters in Europe*, 199–211. Oxford.
- Nesbitt, M., and Samuel, D. (1996) From staple crop to extinction? The archaeology and history of the hulled wheats. In S. Padulosi, K. Hammer and J. Heller (eds) *Hulled Wheats, Promoting the Conservation and Use of Underutilised and Neglected Crops*, 41–100. Rome.
- Palmer, C. and van der Veen, M. 2002. Archaeobotany and the social context of food. *Acta Palaeobotanica* 42, 195–202.
- Petrucchi-Bavaud, M., Schlumbaum, A. and Jacomet, S. (2000) Bestimmung der botanischen Makroreste. In D. Hintermann (ed.) *Der Sudfriedhof von Vindonissa*, 151–159. Zug.

- Sarpaki, A. (1987) *The Palaeoethnobotany of the West House, Akrotiri, Thera. A Case Study*, Unpublished PhD thesis, University of Sheffield.
- Sarpaki, A. (2011) Archaeobotanical seed remains. In A. Sampson (ed.) *The Cave of the Cyclops: Mesolithic and Neolithic Networks in the Northern Aegean, Greece*. Volume II: *Bone Tool Industries, Dietary Resources and the Paleoenvironment, and Archeometrical Studies*, 315–324. (Prehistory Monograph 31). Philadelphia.
- Sigaut, F. (1988) A method for identifying grain storage techniques and its application for European agricultural history. *Tools and Tillage* 7, 3–32.
- Smith, R. A. K., Dabney, M., Kotzamani, G., Livarda, A., Tsartdiou, G. and Wright, J. C. (2014) Plant use in Mycenaean Mortuary Practice. In G. Touchais, R. Laffineur, F. Rougemont, H. Prokopiou and S. Andreou (eds.) *PHYSIS. L'environnement naturel et la relation homme-milieu dans le monde égéen protohistorique. Actes de la 14e Rencontre Égéenne Internationale, Paris, Institut National d'Histoire de l'Art, 11–14 Décembre 2012*, 265–270. (Aegaeum 37). Leuven-Liège.
- Stevens, C. (2003a) An investigation of agricultural consumption and production models for prehistoric and Roman Britain. *Environmental Archaeology* 8, 61–67.
- Stevens, C. (2003b) An investigation of agricultural consumption and production models for Prehistoric and Roman Britain. In S. Colledge and J. Conolly (eds) *Archaeobotanical Perspectives on the Origins and Spread of Agriculture in Southwest Asia and Europe*, 375–390. London.
- Stratouli, G., Triantafyllou, S., Bekiaris, T. and Katsikaridis, N. (2010) The manipulation of death: a burial area at the Neolithic Settlement of Avgi, NW Greece. *Documenta Praehistorica* 37, 95–104.
- Stratouli, G., Sarpaki, A., Ntinou, M., Kotjapopoulou, E., Theodoropoulou, T., Melfos, V., Andreasen, N. H. and Karkanas, P. (2014) Dialogues between bioarchaeological, geoarchaeological and archaeological data: approaches to understanding the Neolithic use of Drakaina Cave, Kephallonia island, Western Greece. In G. Touchais, R. Laffineur, F. Rougemont, H. Prokopiou and S. Andreou (eds) *PHYSIS. L'environnement naturel et la relation homme-milieu dans le monde égéen protohistorique. Actes de la 14e Rencontre Égéenne Internationale, Paris, Institut National d'Histoire de l'Art, 11–14 Décembre 2012*, 23–32. (Aegaeum 37). Leuven-Liège.
- Tomkins, P. (2009) Domesticity by default. Ritual, ritualization and cave-use in the Neolithic Aegean. *Oxford Journal of Archaeology* 28, 125–153.
- Tomkins, P. (2012) Landscapes of ritual, identity and memory. Reconsidering Neolithic and Bronze Age cave use on Crete, Greece. In H. Moyes (ed.) *Sacred Darkness: A Global Perspective on the Ritual Use of Caves*, 59–80. Colorado.
- Tutin, T. G. et al.. 1964–1980. *Flora Europaea*. Cambridge.
- Vaiglova, P., Bogaard, A., Collin, M., Cavanagh, W., Mee, C., Renard, J., Lamb, A., Gardeisen, A. and Fraser, R. (2014) An integrated stable isotope study of plants and animals from Kouphovouno, southern Greece: a new look at Neolithic farming. *Journal of Archaeological Science* 42, 201–215.
- Valamoti, S. M. (1992) Απανθρακωμένα φυτικά κατάλοιπα από την προϊστορική Θερμή, μια προκαταρκτική μελέτη. *Makedonika* 18, 443–455.
- Valamoti, S. M. (2004) *Plants and People in Late Neolithic and Early Bronze Age Northern Greece. An Archaeobotanical Investigation*. (British Archaeological Reports S1258). Oxford.
- Valamoti, S. M. (2009) Σπόροι για τους νεκρούς; Αρχαιοβοτανικά δεδομένα από τη Μαυροπηγή Κοζάνης, θέση Φυλλοτσαίρι. *Αρχαιολογικό Έργο στην Ανω Μακεδονία* 1, 245–256.
- Valamoti, S. M. & Jones, G. (2003) Plant diversity and storage at Mandalo, Macedonia, Greece: Archaeobotanical evidence from the Final Neolithic and the Early Bronze Age. *Annual of the British School at Athens* 98, 1–35.
- Valamoti, S. M., Moniak, A. and Karathanou, A. (2011) An investigation of processing and consumption of pulses among prehistoric societies: archaeobotanical, experimental and ethnographic evidence from Greece. *Vegetation History and Archaeobotany* 20, 381–396.
- van der Veen, M. (1992) *Crop Husbandry Regimes, An Archaeobotanical Study of Farming in Northern England, 1000 BC–AD 500*. (Sheffield Archaeological Monograph 3). Sheffield.
- Vetters, M., Brysbaert, A., Ntinou, M., Tsartsidou, G. and Margaritis, E. (2016) People and plants: conscious choices or socio-economic necessities? A contextual archaeobotanical, anthracological and phytolith approach to Tiryns's least visible remains, *Opuscula: Annual of the Swedish Institutes at Athens and Rome* 9, 93–192.
- Viklund, K. (1998) *Cereals, Weeds and Crop Processing in Iron Age Sweden*. (Archaeology and Environment 14). Umeaa.
- Zohary, D., Hopf, M. and Weiss, E. (2011) *Domestication of Plants in the Old World*. Fourth Edition. Oxford.

The exploitation of marine animal resources at Alepotrypa Cave: harvesting strategies, management and uses

Tatiana Theodoropoulou

Introduction

The exploitation of animal resources within Neolithic cave contexts in the Aegean has gradually attracted the attention of zooarchaeological research over the last decades (Trantalidou *et al.* 2011). As with various faunal remains, the study of those of marine animals at an increasing number of sites has significantly contributed to a better understanding of the role that they played in the Neolithic diet. The research has also revealed their uses and connotations well beyond the needs of subsistence.

The cave of Alepotrypa offers yet another example of coastal cave-habitation in the Neolithic Aegean. The cave actually lies at some 50 m from the sea today (Figure 17.1; CP II 41). Although its location during the Neolithic, given the lower sea level at the time (c. 6 m lower at around 6,000 cal BC), would have been somewhat farther inland from the coast (Takis Karkanias, pers. comm.), it would still have lain in close proximity and within sight of it. The particular connection of Alepotrypa Cave with the sea has already been revealed by several different lines of evidence throughout the long excavation history of the site (Papathanassopoulos 2011, 40–42, 61–62). Various elements, including environmental finds and artefacts, point to a community largely oriented towards the sea, with a deep knowledge of the coastal and marine environments.

The abundant marine faunal material consists of invertebrate and fish remains. With the exception of a few remains of sea turtles (Hadjikoumis, this volume), no other marine animals (mammals, birds) have been identified, while the exploitation of other marine resources (marine flora, salt) is almost impossible to identify archaeologically. The shell material from the old excavations has been preliminary presented (Karali 1983; 1998), while a rich collection of ornaments made of shell has interested scholars studying Neolithic ornament production and technology. However,

until now no overall synthesis of this particularly varied material has been offered. The recent study program sought a complete analysis of the marine animal remains retrieved during the excavations conducted from the 1970s until 2007. For the needs of this chapter, an integrated approach to the results has been adopted. The main research questions of the role of fishing and shell-collecting and of the diverse exploitation of marine resources by Neolithic users of Alepotrypa Cave are discussed within the general context of subsistence, seasonality and cave use in the Neolithic Aegean, as well as the particular role wild resources played in this period. These themes are explored through various lines of evidence, whether faunal, environmental or archaeological, and go hand in hand with other faunal studies presented in this volume (Hadjikoumis). At the same time, this study raises new research questions to be better investigated in the future.

Materials and methods

Sampling

Sampling and the recording of primary data (species identification, quantification) are the first steps towards the analysis of an assemblage and its interpretation. The study involved all marine animal remains retrieved from secure and datable contexts throughout the four decades of excavations at the site. During the long excavation history of the site, most of the material was recovered through hand collection, while coarse dry sieving was not introduced until the late 1980s, and wet sieving was only employed in the last years of excavation. The last process is expected to have an impact upon the composition of the marine animal material. As pointed out by various authors (*e.g.*, Clason and Prummel 1977), although the larger mollusc and fish species as well as the more robust anatomical

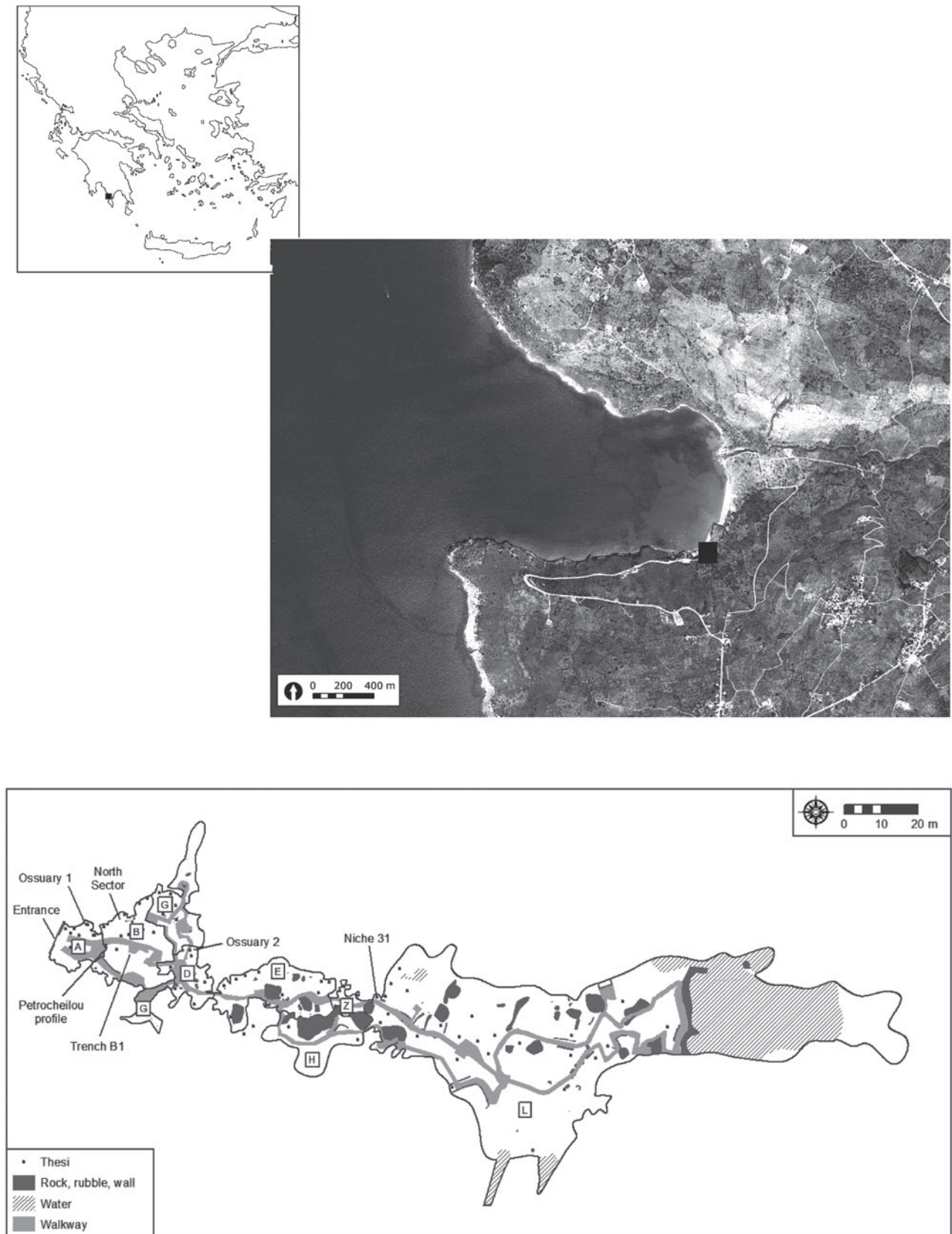


Figure 17.1. Map of Greece with location of Alepotrypa Cave, view of the Diros Bay, and plan of the cave (© from the top, Tatiana Theodoropoulou, DirosWorldView-courtesy Digital Globe Foundation, Rebecca Seifried, Diros Project).

units of fish may be retrieved through hand-collecting, smaller species and more fragile remains of larger animals will most likely be underrepresented or completely absent from the record in the absence of a thorough retrieval strategy. The marine samples from Alepotrypa mostly comprise parts of adult molluscs – including bivalves, gastropods and scaphopods – of all sizes, small fragments of decapods, a sepioid cuttlefish, and the cranial and various post-cranial elements (vertebrae, ribs, girdles and fins, scales) of medium to large bony and cartilaginous fish. The quite satisfactory degree of representation, for the standards of hand retrieval, is also suggested by the terrestrial animal remains, which include large numbers of newborn animals (mainly sheep, goat and pig), as well as some of small mammals (*e.g.*, cat, marten, hedgehog and hare) and birds (Hadjikoumis, this volume). On the other hand, the sample is biased against smaller fish elements (small vertebrae and cranial fragments, otoliths, scales), which have only been retrieved from the few water-sieved samples. A similar deficiency is also observed in micromammal remains, which also lack small anatomical elements and smaller species (Papayianni, this volume).

Methodology

The shell assemblage and ornaments made of shell were studied at the storehouse of the archaeological site, while the fishbone assemblage was examined at the Wiener Laboratory at the American School of Classical Studies at Athens. Primary analysis followed standard zooarchaeological methods, including species identification, counting, and recording of pre- and post-depositional markers. Shell remains were identified with the help of general handbooks for the Mediterranean and the Aegean Seas (D'Angelo and Garguillo 1978; Delamotte and Vardala-Theodorou 1994; Fischer *et al.* 1987; Pope and Goto 1991). Identification of shell remains was in most cases achieved to family, genus and species level. Nomenclature follows WoRMS online checklist (WoRMS Editorial Board 2016). Fish bones were identified with the help of the modern fishbone reference collection based at the Wiener Laboratory, as well as the author's personal collection. Further checks included online fishbone reference collections (Tercerie *et al.* 2015; VV. AA. 2011). Anatomical terminology is based on Canon (1987), Lepiksaar (1981–1983) and Rojo (1991). Identification of cranial bones and vertebrae was in most cases pushed to family, genus and species level. Other cranial fragments and post-cranial elements (spines/ribs, ribs, scales, fragments of the neurocranium and the suspensorium) could not be attributed to a genus/species. Taxonomic references, nomenclature, and information on fish habitats and ecology are based on online resources and specific atlases (Collette and Nauen 1983; Eschmeyer *et al.* 2016; Eschmeyer and Fong 2016; Froese and Pauly 2016; Goujon and Majkowski 2000).

General counts of shells are given both in Numbers of Identified Specimens (NISP) and in Minimum Numbers

of Individuals (MNI). The quite satisfactory degree of fragmentation, as well as the dominance of two families, *i.e.*, limpets and topshells, made the use of MNI in the discussion possible, as this manner of counting is closer to the number of animals originally present in a given archaeological context. It is thus preferred in producing environmental reconstructions of ancient exploitation patterns (Reitz and Wing 1999, 194). On the other hand, it was often difficult to provide accurate MNI counts of shells used in ornament production, as one whole individual could be chopped down to provide more than one ornamental piece, especially beads made from tusk shell. This problem was minimised for the beads made from dove shells, as the latter had received but minimal modification that still enabled an estimation of MNI. Fish bone counts are given in NISP and in NISP_i (NISP of identified taxa), in order to exclude any inflation due to unidentifiable fish bones. All subsequent calculations are based on the latter set of numbers. The dominance of anatomical elements, such as vertebrae and other non-paired post-cranial elements, did not allow for MNI reconstructions (MNI was estimated in specific contexts, when possible).

Various types of analyses were performed on these primary and secondary counts. The Alepotrypa material offers the opportunity to apply common indexes used in ecology in order to seek evidence indicating a change in the resource base or in the use of resources (Reitz and Shackley 2012, 371). The approach combines data on numbers of taxa and abundance within each taxon to describe the diversity in different contexts within an assemblage. As the material under study, in contrast to when conducting an ecological analysis, is subject to human selection, it is not only associated with naturally available animal communities and ecosystems, but also, and critically, with social and economic choices. Accordingly, the two major periods represented at Alepotrypa, *i.e.*, the Late Neolithic and the Final Neolithic, were explored for their taxonomic richness (number of taxa), diversity (H' , relative numbers of individuals for each taxon) and equitability (the even or uneven use of individual taxa). For this study, the measures chosen were the Kruz-Urbe index for richness dl (Kruz-Urbe 1988), the Shannon-Weaver index for diversity H' (Reitz and Wing 1999, 234–235), coupled to the equitability index ($V' > 1$ = complete evenness). Finally, the use of the Jaccard similarity index (SC_j) made possible a quantitative comparison of the biodiversity of the two assemblages.

The use of measurements on both types of materials is particularly helpful in assessing original body sizes, growth rates and habits, types of fishing tackle, dietary contributions, as well as stresses related to human predation. The approach is based on the fact that marine organisms tend to grow in size and weight steadily. Measurements on the two recurrent taxa of molluscs, limpets and topshells, were thus used to detect potential decrease of body size in these two taxa related to continuous predation from

the Late Neolithic to the Final Neolithic. Allometric equations are also particularly helpful in fish analyses. Almost all elements of the fish skeleton show remarkable correlations between their specific dimension and the size (length and body mass) of the fish themselves. It is thus possible to reconstruct the size and weight of fish found in archaeological sites (Desse and Desse-Berset 1996b). During the study, all complete identifiable vertebrae and cranial bones were measured following systematised standards (Desse and Desse-Berset 1996b, 1996c; Morales and Rosenlund 1979). Fish size reconstructions were possible for species for which sufficient allometric data exist, *i.e.*, for sea breams and groupers. Although tunas and mackerels are members of the family most frequently encountered at Alepotrypa, the available biological studies on age and growth of the various Scombrid species usually rely on otoliths and dorsal fin spines, as quantifying these parts can be done without killing and mutilating the fish, as happens with other skeletal elements, namely vertebrae (Ruiz *et al.* 2005). However, of these body parts, the former is absent in the Alepotrypa material, while the latter is not easily assigned to different species or individuals, thus preventing reliable MNI size reconstructions. Bone measurements of some Scombrids from Alepotrypa were nevertheless partly and broadly usable, as they could be compared to modern skeletal material of known size from the reference collections and generally placed within length-weight plots known for the East Mediterranean (Peristeraki *et al.* 2003). It should be noted that the numbers provided are only approximate, as the parameters of the length-weight equation in fish are affected by a series of biological or environmental factors (habitat, sex, maturity, stomach fullness, health, intra-species differences), which cannot be assessed in archaeological material. A more refined exploitation of the data is yet to be undertaken.

Reconstruction of the season when shells and fish are collected/caught is another secondary analysis offered by archaeological aquatic remains. The method is based on the observation that aquatic organisms living in cold and temperate waters are affected by seasonal environmental changes (cold/warm season), which, in turn, influence calcification and growth rate, as is reflected in the growth rings in their skeleton/shell. For fish, one groove and one ridge, visible on most anatomical elements (most accurate on vertebrae centra and otoliths, when preserved), are usually considered as equalling one year's growth, and the stained rings note the yearly slow-down in their growth (Desse and Desse-Berset 1992). A similar method is applied to shells, either macroscopically or microscopically (thin sections) (Claassen 1988). The method suffers from a number of methodological constraints, including the difficulty in distinguishing between year-rings and spurts of growth that create extra rings, especially in shells. The observations also need to be made on whole, unworn samples, present in statistically significant quantities and be compared to modern year-round sequences from the

same region (Campana 2001; Carlson 1988; Desse and Desse-Berset 1992; Jones 1988). Taking into account these limitations and due to administrative difficulties related to obtaining permits for thin-sectioning, it was decided to work macroscopically on the fishbone material of Alepotrypa, as it contains a significant number of whole vertebrae, which were cleaned and viewed in white light.

Pre- and post-depositional alterations, from natural causes or human-derived (*i.e.*, involving traces of fire, opening with a tool, perforations or other signs of working, wear, weathering), were also observed (macroscopically and with a hand-lens), to be subsequently recorded, counted, and measured. A particular note needs to be added here, with respect to the ornaments made of shell. Ornaments had been normally retrieved during excavation, given special ID numbers and stored separately from the other shells. During the present research, these items were studied and recorded. However, as this chapter is devoted to a general appreciation of fishing/collecting strategies and the overall exploitation of marine resources at Alepotrypa, it has been decided to only briefly consider this group of finds, without detailing the technological aspects of production. Counts and the chrono-spatial analysis of these items are included in the general presentation, but they are also dealt with separately. A small number of worked shells found among general shell samples, which had not been scrutinised for ornaments, are also included in these counts. Similarly, during excavations at the site, a number of fish bones (spines, ray, ribs) had been identified as tools of bone (*i.e.*, not attributed specifically to fish) due to their pointed shape and cut marks, and had been stored separately with the relevant bone finds. These items are here included with the other fish bones, and their dietary versus non-dietary use is discussed below.

Finally, the assignment of shell and fish-bone samples to specific contexts revealed broad spatial and chronological patterns. The bulk of the material comes from Chamber B, but other chambers also yielded marine remains (Z-Niche 22, A, D, and the Chamber of Lakes). The spatial distribution and relevant interpretation is to be found in the paragraphs on the uses of marine resources in the cave. Most samples are datable to one of three Neolithic phases (late Early Neolithic, *c.* 6,000 cal BC, Late Neolithic, *c.* 5,500–4,500 cal BC, or Final Neolithic, *c.* 4,500–3,200 cal BC), or to transitional/mixed layers (Middle/Late Neolithic, Late/Final Neolithic disturbed). Other samples (mixed Early to Final Neolithic), although processed and briefly presented in the general tables, were not included in the final results.

Results

The presence of marine animals through time

The marine faunal assemblage from Alepotrypa Cave is made up of 3,228 invertebrate remains and 630 fish bones (Tables 17.1 and 2). Of these, 3,004 invertebrate and 498

Table 17.1. The Neolithic shell assemblage from Alepotrypa: species representation by phase (NISP, MNI)

Class/Family	Common name	Taxon	late Early Neolithic				Middle/Late Neolithic				Late/Neolithic				Final Neolithic				Total NISP	Total MNI	Early to Final Neolithic (mixed)			
			NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	%NISP	%MNI	NISP	MNI	NISP	MNI
Bivalvia																								
Arcidae	Noah's ark	<i>Arca node</i>																						
Cardiidae	Cockle	<i>Cerastoderma glaucum</i>																						
Glycymeridae	Bittersweet	<i>Glycymeris sp.</i>																						
Mytilidae	Mussel	<i>Mytilus galloprovincialis</i>																						
Ostreidae	Oyster	<i>Ostrea sp.</i>																						
Pinnidae	Thorny oyster	<i>Pinna nobilis</i>																						
Spondyliidae	Clam	<i>Spondylus gaederopus</i>																						
Veneridae		<i>Chamelea gallina</i>																						
Scaphopoda																								
Dentaliidae	Tusk shell	<i>Antalis (unaccepted Dentalium)</i>																						
		<i>inaequicostata</i>																						
		<i>Antalis sp.</i>																						
Gastropoda																								
Buccinidae	Whelk	<i>Buccinum corneum</i>																						
Cassidae	Ridged bonnet	<i>Semicassis granulata</i>																						
Cerithiidae	Horn shell	<i>Cerithium vulgatum</i>																						
Columbellidae	Dove shell	<i>Columbella rustica</i>																						
Conidae	Cone shell	<i>Conus ventricosus (unaccepted mediterraneus)</i>																						
Cypraeidae	Cowrie	<i>Luria lurida</i>																						
Fasciolaridae	Tulip shell	<i>Fasciolaria lignaria</i>																						
Mitridae	Mitra shell	<i>Mitra cornicula</i>																						
Muricidae	Purple-dye murex	<i>Hexaplex trunculus</i>																						
Nassariidae	Dog whelk	<i>Tritia (unaccepted Cyclope) neritea</i>																						
		<i>Tritium corniculum</i>																						
Patellidae	Limpet	<i>Patella caerulea</i>																						
		<i>Patella ulyssiponensis</i>																						
		<i>Patella rustica</i>																						
		<i>Patella sp.</i>																						
Ranellidae	Triton shell	<i>Monoplex (unaccepted Cymatium) corrugatus</i>																						
		<i>Monoplex (unaccepted Cymatium) parthenopeus</i>																						
		<i>Charonia tritonis</i>																						
		<i>Monoplex sp.</i>																						
Tonnidae	Helmet shell	<i>Tonna galea</i>																						
Trochidae	Topshell	<i>Phorcus (unaccepted Monodonta) turbinatus</i>																						

(Continued on next page)

Table 17.1. The Neolithic shell assemblage from Alepotrypa: species representation by phase (NISP, MNI) (Continued)

Class/Family	Common name	Taxon	late Early Neolithic	MNI	NISP	MNI	Middle/Late Neolithic	MNI	NISP	MNI	Late Neolithic	MNI	Late/Final Neolithic	MNI	Final Neolithic	Total NISP	Total MNI	Early to Final Neolithic (mixed)			
			NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	%NISP	%MNI	NISP	MNI			
Unidentified molluscs	Cephalopoda	<i>Phorcus</i> (unaccepted <i>Monodonta</i>) <i>articulatus</i> <i>Phorcus</i> (unaccepted <i>Monodonta</i>) <i>mutabilis</i> <i>Phorcus</i> sp. <i>Gibbula divaricata</i> <i>Gibbula varia</i> <i>Gibbula</i> sp.			4	4	86	84	5	5											
					3	3	1	1	1	1											
				8	277	4			79	5									31	1	
				3	3	2	2	12	1	3	3										
				2	2	12	12	1	1	16	16										
					4	3	1	1	2	2											
				7																	
															7	0.2	0	0.0			
Cephalopoda	Cuttlefish	<i>Sepia officinalis</i>																			
Decapoda	Crab				2	2															
Total invertebrates			2	2	102	89	1611	859	214	184	1075	754	3004	100	1888	100	224	77			

Table 17.2. The Neolithic fishbone assemblage from Alepotrypa: species representation by phase (NISP)

Class/Family	Taxon	Common name	late Early Neolithic	Middle/ Late Neolithic	Late Neolithic	Late/ Final Neolithic	Final Neolithic	Total NISP Taxa	Total NISP Taxa %	Total NISP Family	Total NISP Family %	NISP Early– Final Neolithic (mixed)
Chondrichthyes												
Rajidae	<i>Raja cf. clavata</i>	Ray					1	1	0.2	27	8.6	
Triakidae/Carcharinidae	<i>Galeorhinus</i> sp./ <i>Carcharinus</i> sp.	Shark			5		13	18	3.6			
Carcharinidae	<i>Carcharinus</i> sp.	Shark					6	7	1.4			
Lamnidae	<i>Isurus oxyrinchus</i>	Bonito shark		1			1	1	0.2			
unidentified shark/ray		Shark/ray		3			3	3	0.6			
Osteichthyes												
Anguillidae	<i>Anguilla anguilla</i>	Eel					1	1	0.2	1	0.3	
Moronidae	<i>Dicentrarchus labrax</i> ?	Seabass					2	2	0.4	2	0.6	
Mugilidae	<i>Liza ramada</i>	Thinlip grey mullet					1	2	0.4	7	2.2	
	<i>Oedalechilus labeo</i>	Boxlip mullet		1			4	4	0.8			1
	<i>Mugil</i> sp.	Mullet					1	1	0.2			
Muraenidae	<i>Muraena helena</i>	Mediterranean moray					3	3	0.6	3	1.0	1
Scaridae	<i>Sparisoma cretense</i>	Parrotfish					5	5	1.0	5	1.6	1
Sciaenidae	<i>Argyrosomus regius</i>	Meagre										1
Scombridae	<i>Axius rochei</i>	Bullet tuna	1	1			12	44	8.8	227	72.1	7
	<i>Euthynnus alletteratus</i>	Little tunny		1			31	40	8.0			1
	<i>Katsuwonus pelamis</i>	Skipjack tuna					1	1	0.2			
	<i>Sarda sarda</i> ?	Atlantic bonito			3		2	5	1.0			
	<i>Scomber japonicus</i>	Chub mackerel			2		2	2	0.4			1
	<i>Thunnus alalunga</i>	Albacore tuna			2		8	10	2.0			
	<i>Thunnus thynnus</i>	Bluefin tuna	1		1	2	23	27	5.4			3
	<i>Thunnus</i> sp.	Tuna		3	15		33	51	10.2			1
	unidentified		1	1	22	2	21	47	9.4			
Serranidae	<i>Epinephelus aeneus</i>	White grouper					13	13	2.6	29	9.2	1
	<i>Epinephelus marginatus</i>	Dusky grouper			2		12	14	2.8			
	<i>Epinephelus</i> sp.	Grouper					2	2	0.4			2
Sparidae	<i>Diplodus sargus</i>	White seabream		1			1	1	0.2	11	3.5	1
	<i>Lithognathus mormurus</i>	Striped seabream					0	0	0.0			4
	<i>Oblada melanoura</i>	Saddled seabream					2	2	0.4			1
	<i>Pagrus</i> sp.	Common seabream					5	7	1.4			1
	<i>Sparus aurata</i>	Gilthead seabream			2		1	1	0.2			
	unidentified				1		1	1	0.2			
Unidentifiable				1	42	4	135	182	36.5			104
Total fishes			3	7	140	14	334	498	100	312	100	131

fish remains could be attributed to a specific period or a combination of them. From the shells, 190 modified examples were recorded as ornaments, either during the excavation or during the final studies.

Invertebrates display quite a variety at Alepotrypa. They are mostly represented by the phylum of Mollusca, with the classes of Bivalvia, Gastropoda, Scaphopoda and Cephalopoda. The phylum of marine Arthropoda is also present. The material is dominated by two gastropod families, namely limpets (Patellidae: *Patella caerulea*, *P. ulyssiponensis*, *P. rustica*, 60.7% NISP or 63.2% MNI) and topshells (Trochidae: *Phorcus turbinatus*, *Ph. articulatus*, *Ph. mutabilis*, *Gibbula varia*, *G. divaricata*, 24.8% NISP or 20% MNI). Murex shells (*Hexaplex trunculus*) are modestly represented with 3% NISP (4.4% MNI). Dove shells (103 *Columbella rustica*) and cone shells (30 *Conus ventricosus*) are also quite important. Another 19 families and 22 species are represented with less than a dozen, indeed usually one to three specimens.

Fish remains are mainly represented by Scombrids, which make up 46% NISP. Although there exist a high number of unidentifiable specimens (37.7%) overall, such as ribs, spines and rays, as well as non-diagnostic fragments from the neurocranium and suspensorium, it is possible that these pieces belong to the dominant Scombrid family. This latter family is represented by both species of *Thunnus* sp. occurring in the Mediterranean, namely the bluefin tuna (*T. thynnus*) and the albacore (*T. alalunga*), as well as other species (the little tunny *Eythunnus alletteratus*, the bullet tuna *Auxis rochei*, the chub mackerel *Scomber japonicus*, the skipjack tuna *Katsuwonus pelamis*, and the bonito *Sarda sarda*). Groupers (Serranidae) are also well represented by two species (white grouper *Epinephelus aeneus*, dusky grouper *Epinephelus marginatus*). Sparids, although not very abundant in the material (10 NISP), are interestingly

represented by at least five different species (white seabream *Diplodus sargus*, striped seabream *Lithognathus mormurus*, saddled seabream *Oblada melanura*, common seabream *Pagrus* sp., and gilthead seabream *Sparus aurata*). Other families are present at one to six specimens, namely mullets (Mugilidae), the parrotfish (*Sparisoma cretense*), the European seabass (*Dicentrarchus labrax*), the Mediterranean moray (*Muraena helena*) and the eel (*Anguilla anguilla*). Finally, the fish bone material offers a number of shark and ray remains, of which *Raja clavata*, *Isurus oxyrinchus* and possibly *Galeorhinus galeus* and *Carcharinus* sp. could be identified.

The marine animal material then, taken together, is quite abundant and diversified. One of the goals of this study was to examine potential changes in the resource exploitation of the two major periods represented at Alepotrypa, the Late and Final Neolithic. The indexes of richness, diversity, equitability and similarity were applied to both invertebrate and fish assemblages.

Invertebrate exploitation interestingly remains quite stable across these periods (Figures 17.2 and 3). The two assemblages are represented by similar numbers of individuals and similar numbers of taxa (similarity between the two plots at 65.2% at the family level), which both decrease slightly from the Late to the Final Neolithic, namely from 21 to 18 families. A shift in species composition concerns a range of minor species: Noah's arks, cockles, clams, triton shells, oysters, mitra shells and horn nassa shells are thus only present in the Late Neolithic, whereas the Final Neolithic material features tun shells, tusk shells, cyclope nassa shells, tulip shells, as well as cuttlefish. The following paragraphs will examine the environmental versus human factors that may have occasioned this shift. Despite these rather small changes between the two periods, both sequences exhibit a low

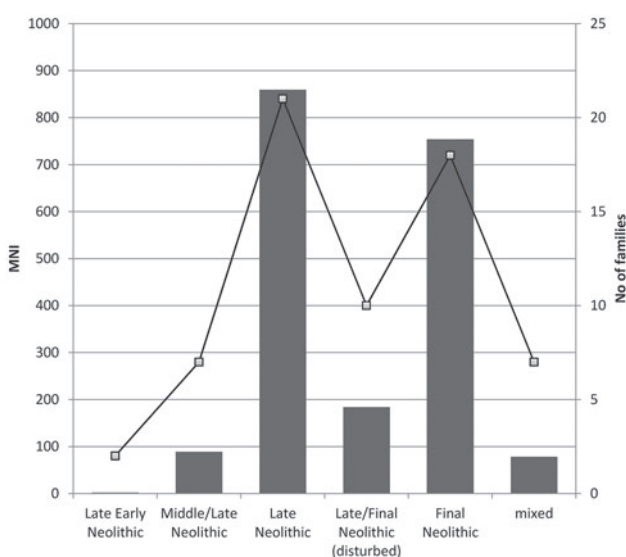


Figure 17.2. Numbers of shells (MNI) and number of families in the different phases of the Neolithic at Alepotrypa.

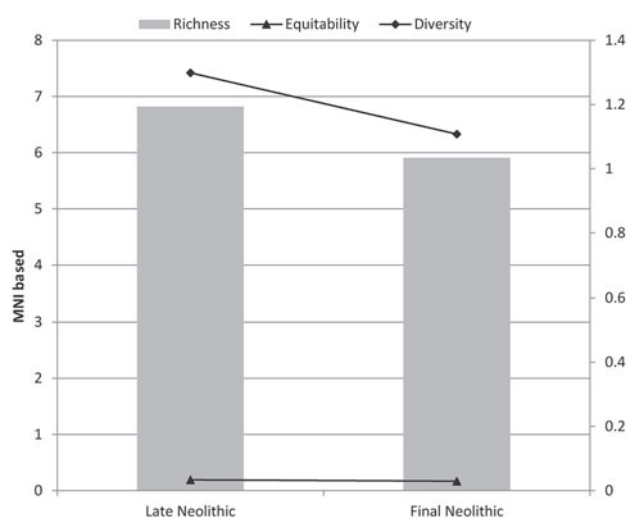


Figure 17.3. Richness, equitability and diversity indexes of shells (MNI) in the Late and Final Neolithic (unidentified specimens excluded).

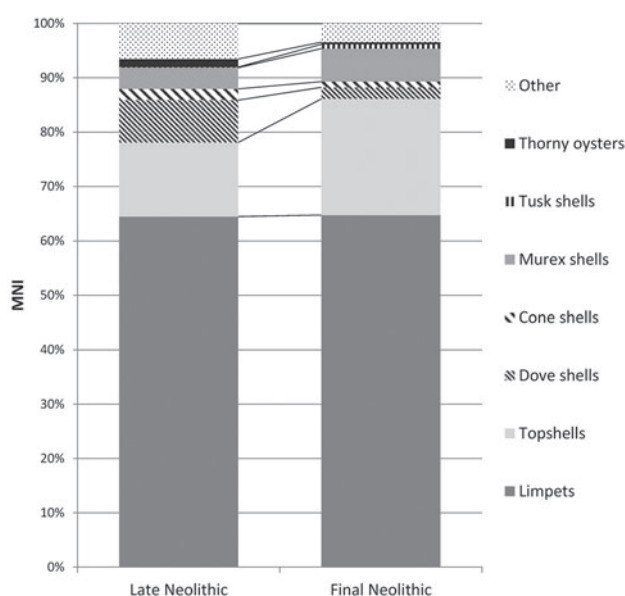


Figure 17.4. Frequencies of dominant invertebrate families (MNI) in the Late and Final Neolithic.

equitability index. This is probably due to the dominance of the two major taxa, limpets and topshells, over a high number of accompanying species. The absolute numbers of the two dominant taxa remain broadly similar in the two major periods, with topshells slightly increasing and limpets slightly decreasing from the Late to the Final Neolithic (Figure 17.4). The relatively stable percentages of both species do not suggest a depletion of the natural beds from one period to the next. However, both taxa show a considerable size decrease in the Final Neolithic (Figures 17.5 and 6), the reasons for which might be attributed to the overharvesting of larger individuals during the Late Neolithic.

The fish bone assemblage offers a different pattern of development (Figures 17.7 and 8).¹ The material increases in quantity by $\times 2.6$ from the Late to the Final Neolithic; the richness in the spectrum exploited too increases with five new families added and a few additions of species among already known families. The Final Neolithic thus exhibits a higher diversity, but not proportionally: the new species added do not contribute significant numbers to the NISP. Rather, both assemblages are dominated by a variety of Scombrids: most are present in both periods, with the exception of the chub mackerel, only present in the Late Neolithic (Figure 17.9). Despite the higher numbers of the remains of this family in the Final Neolithic, their relative importance decreases, as two other groups, groupers and sharks/rays, rise (Figure 17.10). The consistent presence of all three dominant groups, together with sea breams and mullets, accounts for a quite high similarity index (41.6% at family level, 48.4% at species level).

The following paragraphs will give an explanation of the environmental information provided by these assemblages, as well as human strategies developed

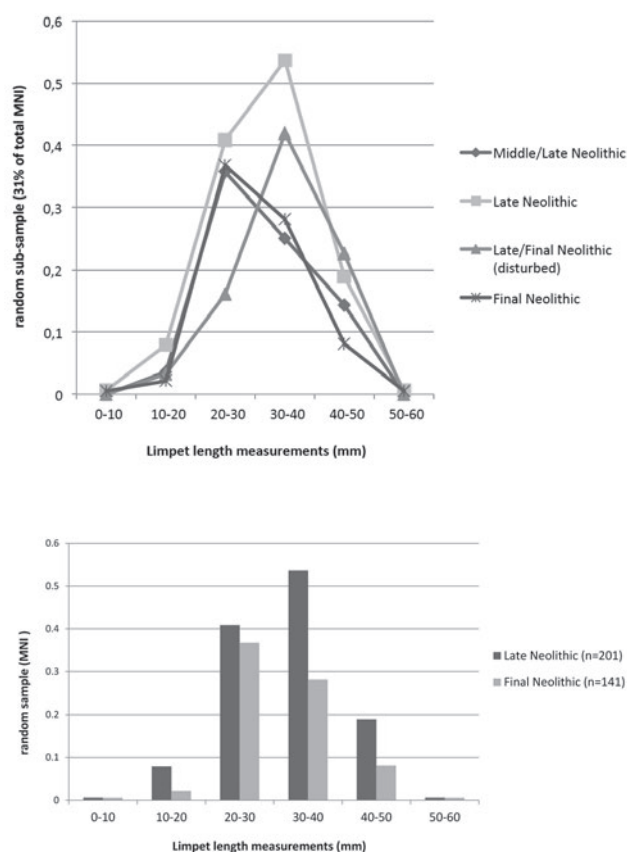


Figure 17.5. Size distribution of whole limpets (all species included) throughout the stratigraphical sequence (random sample, 31% of total MNI) and in the Late and Final Neolithic.

for the harvesting of marine resources, including the environments exploited, the fishing/collecting methods, and the seasonal organisation of these activities.

Aspects of exploitation strategies of aquatic environments

Exploited habitats

The reconstruction of the natural habitats of the invertebrates and fish present holds out the possibility of reconstructing the harvested environments and, at least partly, the available marine resources.

The shell spectrum is quite consistent in both Neolithic phases and suggests a relatively similar environment to the modern one. Rock-dwelling species, limpets and topshells, collected from the fringe levels of the shore to a few meters beneath the surface of the water are dominant (Figure 17.11). Other taxa found in the same or similar habitats are dove shells, cone shells, whelks, cowries, tulip shells, little trumpet shells and thorny oysters. Although found in but very restricted numbers, they are not believed to have been 'accidentally' collected, as it will be argued later. A minor presence of shells inhabiting soft substrates as well as brackish conditions is also observed, namely in the Late Neolithic. Although

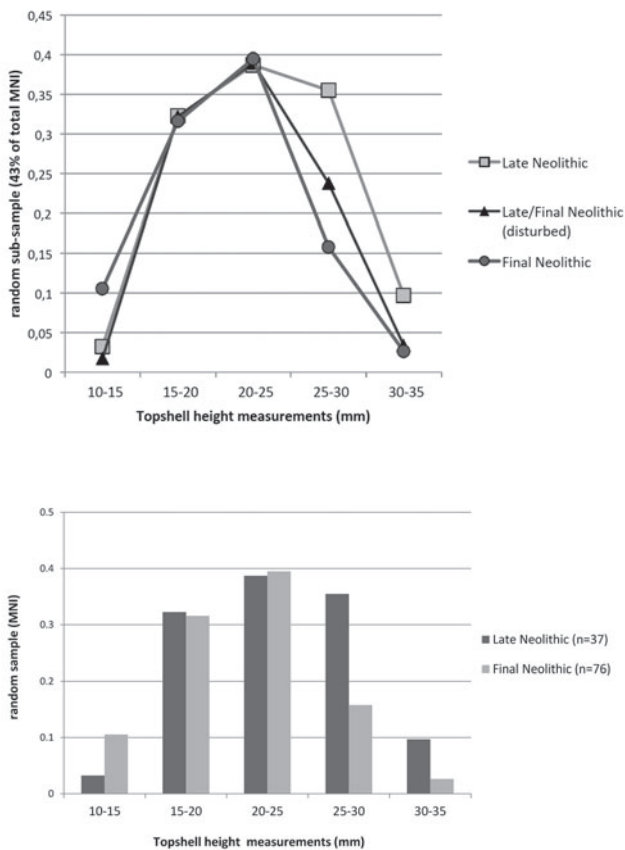


Figure 17.6. Size distribution of whole topshells (all species included) throughout the stratigraphical sequence (random sample, 43% of total MNI) and in the Late and Final Neolithic.

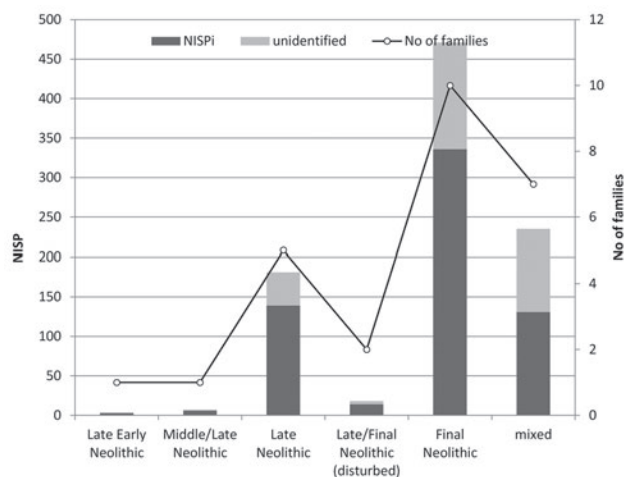


Figure 17.7. Numbers of fish remains (NISP) and number of families in the different phases of Neolithic at Alepotrypa.

their numbers do not suggest a systematic collection from these environments, they do reflect the presence of a different ecosystem, be it near or farther off from the site. Harvesting of molluscs in these other locations is not believed to be accidental nor occurring at visits primarily destined for fishing or other activities, as some of the

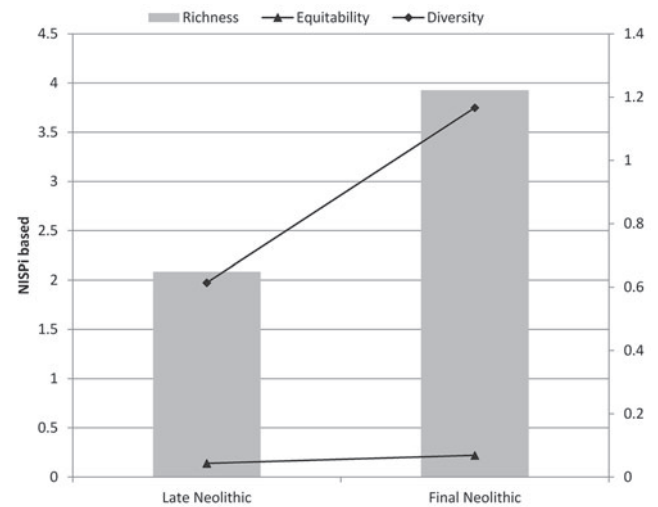


Figure 17.8. Richness, equitability and diversity indexes of fish remains (NISP) in the Late and Final Neolithic (unidentified specimens excluded).

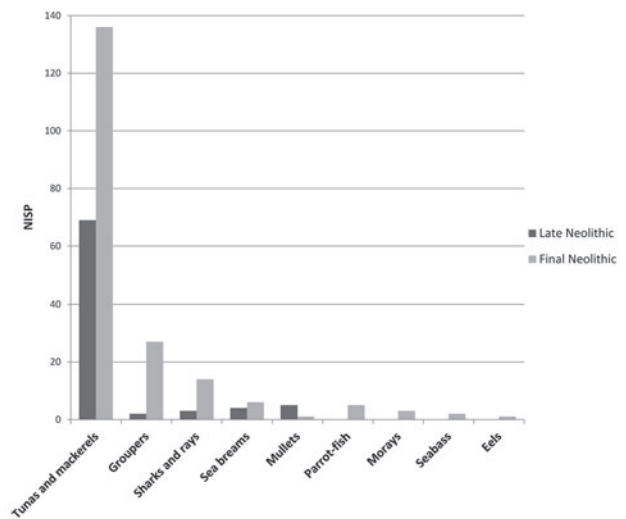


Figure 17.9. Absolute numbers of remains of fish families (NISP) in the Late and Final Neolithic.

shells recovered could have been specifically sought after, such as the tusk shells that are usually transformed into beads (on a similar conclusion regarding various marine resources at Franchthi, see Perlès 2016). Such collecting activity would also include beach combing. A number of shell specimens (c. 6% of the remains) were collected empty on the beach, as they show signs of water- or beach-wear (cf. Shackleton 1988, 50). Those so concerned are mostly dove and tusk shells, thorny oysters, murex shells and tritons, and some of them have indeed served as raw materials for ornament manufacture. Other species, namely limpets, topshells, cowries or cone shells, are only occasionally water-worn: such may be either fortuitously or deliberately collected.

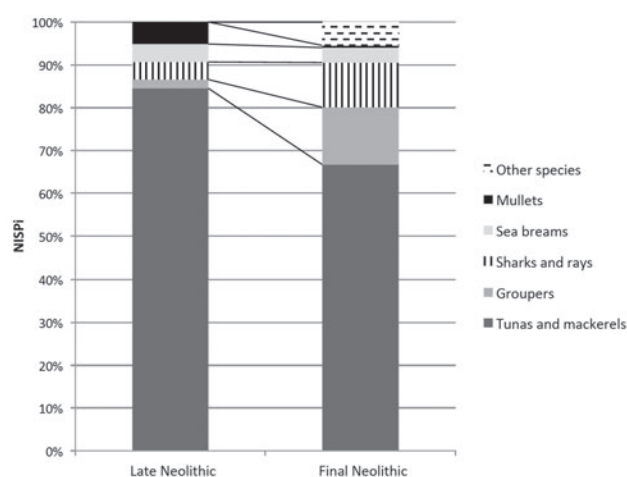


Figure 17.10. Frequencies of dominant fish families (NISPi) in the Late and Final Neolithic.

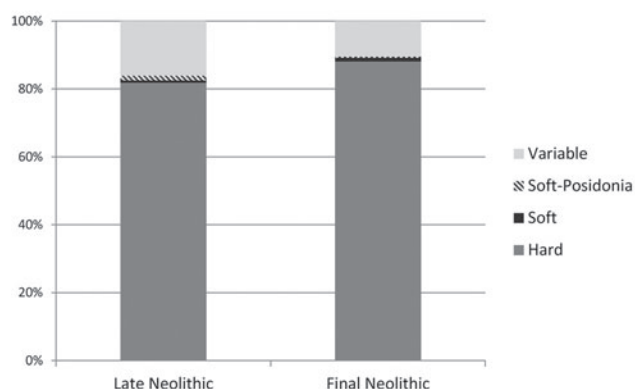
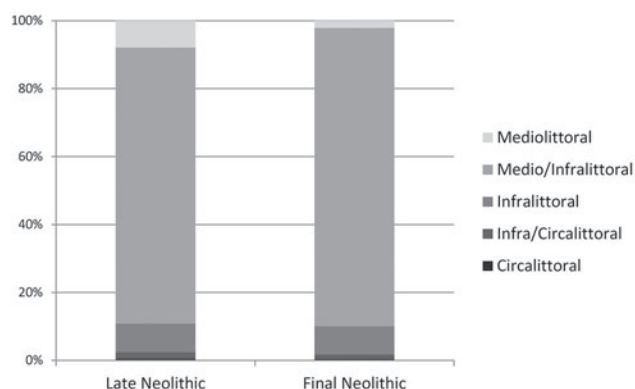


Figure 17.11. Frequencies of exploited marine depths (top) and substrates (bottom) for the collection of invertebrate resources (based on MNI counts) in the Late and Final Neolithic.

The fishbone material reflects a much more varied marine environment (Figure 17.12). The assemblages of both periods are dominated by oceanic taxa (47% and 45% NISP). Bluefin tunas, albacores, skipjacks, bullet tunas and mackerels are all open-sea epi- to mesopelagic fish, usually forming dense schools (more than 5,000

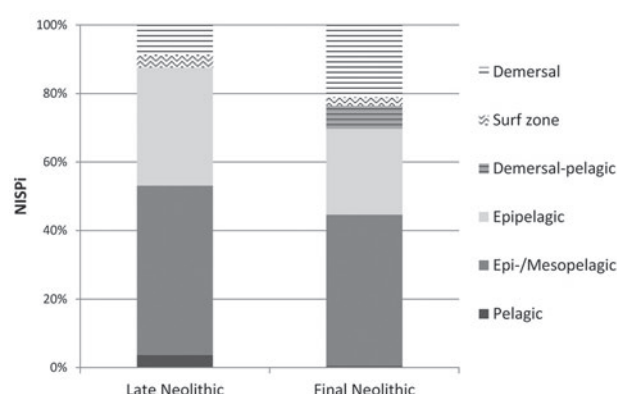
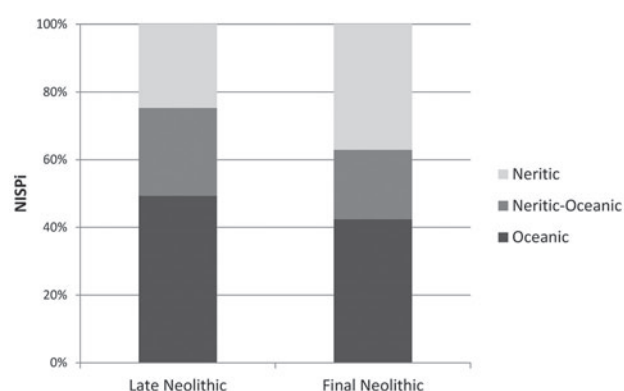


Figure 17.12. Frequencies of exploited marine depths (top) and substrates (bottom) for the collection of fish resources (based on NISPi counts) in the Late and Final Neolithic.

individuals) of the same size; some, such as the bluefin tuna and the skipjack, may also be found among schools of other Scombrids. Large-sized juveniles of bluefin tunas are, therefore, often associated with adult individuals of smaller tuna species, such as skipjack or bonito. Although these fish are generally migratory, following a pattern (generally from March to September) into the Mediterranean to feed and reproduce and then back to the Atlantic, established beliefs about tuna migration routes and the yearly pattern of horizontal and vertical population movements are being reconsidered (De Metrio *et al.* 2005; Tudela *et al.* 2011). Recent studies suggest that some populations, both juveniles and adults, may spend a considerable time in Mediterranean grounds after spawning, depending on favourable foraging. Most of these oceanic species are also found inshore either seasonally or come closer to the shore during the night, following temperature differences or the lunar calendar (full-moon coastal visits) (for the East Mediterranean, see Damalas and Megalofonou 2012). Other fish recovered, namely eels, sharks and rays as well as the thinlip grey mullet may be found either in the open sea or inshore (neritic-oceanic taxa, 27% and 17% NISP). The strictly neritic zone is also the habitat for several taxa identified

at Alepotrypa, especially during the Final Neolithic (38% as against 23% NISP in the Late Neolithic): namely the epipelagic little tunny and Atlantic bonito as well as the demersal groupers and sea breams (the gilthead seabream is also found in the surf zone), the mullets, the seabass, the parrotfish and the moray. Most of them are found in various types of substrates, either sandy-muddy, rocky, or in sea-grass. Fish remains also confirm the presence of a brackish environment, as suggested too by the invertebrate assemblage. Some of the fish identified are tolerant of brackish conditions and can be located in river mouths or lagoons (some sea breams, groupers and the seabass), while others migrate from their marine habitats into the rivers and then outwards, depending on the season or age of individuals (eel, thinlip grey mullet). They are either solitary (groupers, older seabasses and gilthead seabreams, morays) or congregate in schools (various sea breams, grey mullets).

The wide ecological range represented in the Alepotrypa material and species-related ethology offers interesting hypotheses with respect to the organisation of collecting and fishing activities.

Collecting of invertebrates

Overall, most of the upper-shore molluscan resources would have been collected with a simple toolkit, usually a pointed instrument with which to detach limpets and topshells fixed on the hard substrate, as several signs of damage on the edge of the shells suggest (24% and 21% of limpets for the Late and Final Neolithic respectively) (Luchesi 2006). Sometimes, forcing of the rim was necessary to detach the mollusc, as multiple marks on the same shell suggest. No special skills are required for this activity, which could have thus involved most members of the community, including women and children. The size distribution of both major taxa involved, limpets and topshells, at least for the Late Neolithic where small sizes are only rarely present, suggests some kind of selection by the collectors (for size decrease in the Final Neolithic, see above and see Figures 17.6 and 17.7).

The fishing for murex shells is also quite simple: it can be performed with passive fishing gear, usually a baited basket, to attract these carnivorous gastropods (Ruscillo 2002). Other occasionally occurring species, such as fan shells, tun shells, tritons or thorny oysters, may have had to be dived for. Several dove shells and most of the tusk shells, as well as probably a number of thorny oysters, were collected dead on the beach, as suggested by the signs of beach- or water-wear on their surface.

Fishing methods

Fishing, on the other hand, would have certainly involved a higher investment, both in terms of fishing gear and of human labour and social organisation. Fishing implements, such as hooks, net weights or harpoons, are rather rare at Alepotrypa, with the exception of a hook

made of *Spondylus* shell (see below) as well as several needles, which could have served for net-mending (for the presence of fishing tools in the Aegean Neolithic, see Powell 1996, 77–168). It is possible that such apparatus were generally not kept inside the cave, but in the settlement proper (on domestic vs. non-domestic uses of the cave, Papathanasiou, this volume). The ethology of the species and the sizes of the fish thus remain the only way to work out the preferred fishing methods (Figure 17.13).

Central to this whole issue is the exploitation of tunas and other Scombrids, which prevail in the assemblage. The most common species among this family is the bluefin tuna, while the albacore tuna is also present. Tuna fishing involves a range of fishing gear, such as purse seines, longlines, trolling lines, and various other types of nets. Emblematic for tuna fishing is the use of specialised fish traps. Fish traps destined for tuna-fishing have been particularly used in traditional Mediterranean fisheries from Antiquity to recent times (the *θύσσειο* of classical Antiquity; *madrague*, *tonnara*, *dalyan*, etc. Calvet 2016; Faget and Sacchi 2014; Guest-Papamanoli 1984). But such know-how was already attested in the Neolithic (Desse-Berset 1995; Sternberg 2015). What is actually commonly called the *madrague* is a large device composed of various nets fixed on the shore and extending out into the sea to a depth of several metres (45 m): this arrangement forms form traps for the fish (customarily called ‘death chambers’), which are then hauled to the vessels. Sometimes a watchtower is established – to keep a look-out for the tuna shoals. This method involves a deep knowledge of tuna ethology and their seasonal movements, as well as considerable social organisation, manoeuvring and technical skills, the availability and coordination of the several fishermen involved in the actual fishing and of the whole community in support (net-mending, processing of large fish landings, potential transport and sale to other communities) (Ambra Zambernardi, pers. comm.). The investment required is compensated for by the returns from the catches: whole schools can be captured with only one fishing expedition.

The predominance of Scombrids in the material reflects a high degree of familiarity with their specific fishing conditions and a considerable technical knowledge of the fishing gear to be deployed. However, the fishing method arguably employed for tuna fishing at Alepotrypa is not straightforward. Both tuna species are large (according to modern statistical data, commonly 50–150 cm long, but reaching 300 cm and 650 kg in weight for *T. thynnus*; 50–80 cm, up to 127 cm and 40 kg for *T. alalunga*) and fast-swimming animals (the sustained swimming speed for *T. thynnus* is 3.49 m/s). Based on a preliminary estimation, the tuna sizes present at Alepotrypa would generally range between 50 cm and 130 cm, with only two substantially larger individuals, estimated at 180 cm and 210 cm (Figure 17.14).

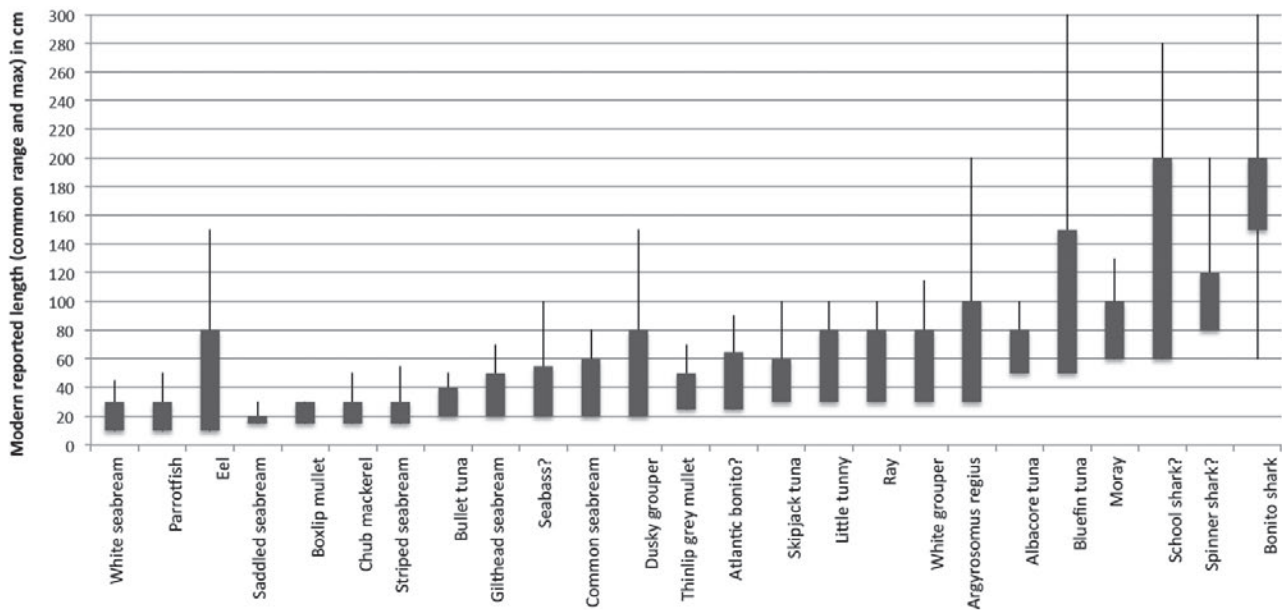


Figure 17.13. Modern common size range and maximum modern lengths of common fish species identified at Alepotrypa (© Tatiana Theodoropoulou, based on FAO and FishBase).

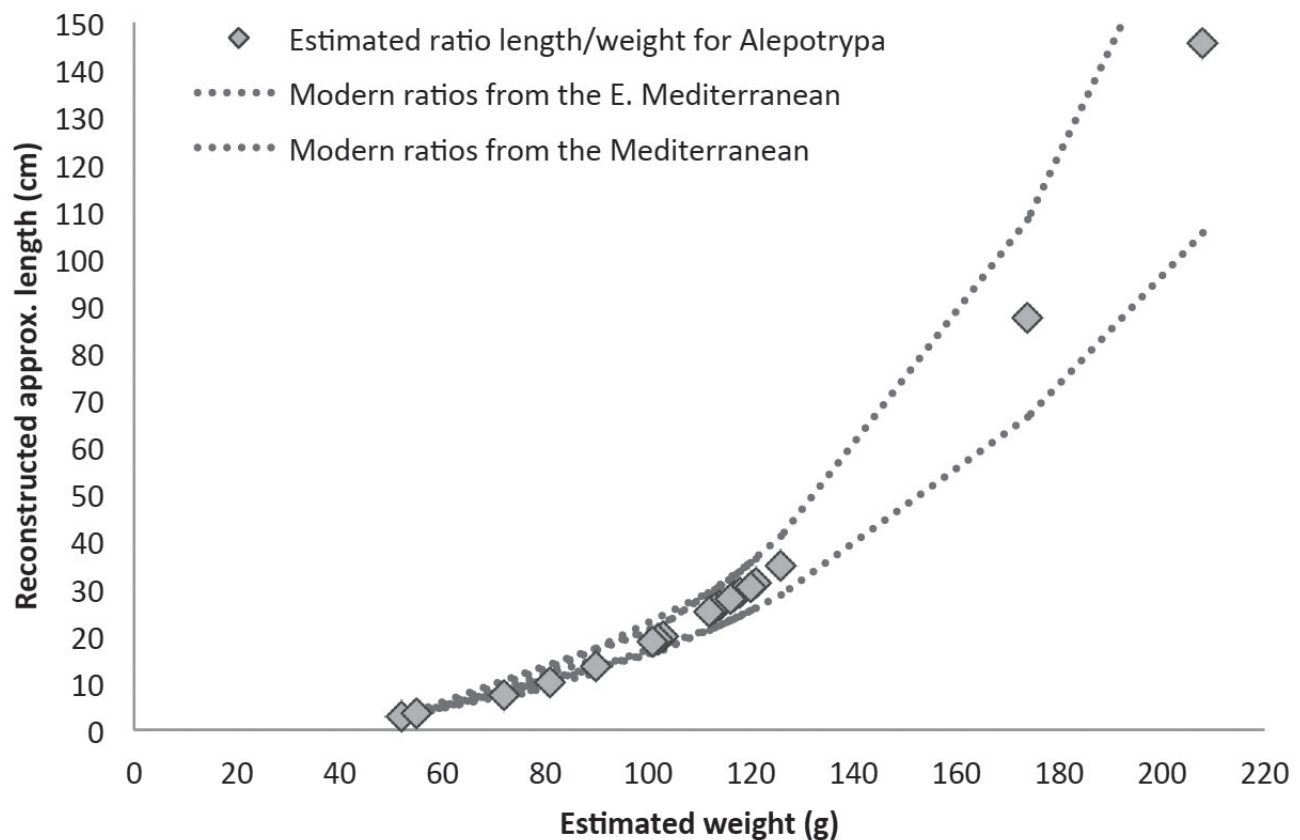


Figure 17.14. Estimated sizes (length) of caught tunas based on measurements of vertebrae.

Fishing for tuna from boats in the open sea would require extensive and resistant nets. The use of some sort of purse seines (a type of dragnet), trawling nets, longlines, or hook and line, is not excluded and it is possible that

such fishing was undertaken at a short distance from the site, just off Diros bay, as actual fishermen of the area still do (information from local fisherman, pers. comm.). Depending on the type, size and depth of the nets, the

tunas caught could be quite sizeable, especially if in deeper waters (for tuna sizes today in the East Aegean, Karakulak *et al.* 2011; Oray and Karakulak 2004).

However, various coastal methods of fishing may have yielded an equally productive catch. The use of fish traps of the Mediterranean model described above is probable. This method allows for large quantities of tunas to be caught seasonally, together with smaller Scombrids found close to the coasts and islands or mixed in with tuna schools, such as the little tunny (common at 30–80 cm, reaching 100 cm and weighing 12 kg), the bullet tuna (common at 15–35 cm, up to 50 kg), the Atlantic bonito (common at 30–50 cm, up to 85 cm and 7.5 kg) and the skipjack (common at 40–80 cm, up to 108 cm and 33 kg). All are present at Alepotrypa, as well as other regular species, such as sharks. The device would involve several long nets, pieces of cork to keep the nets afloat, as well as large stones at the bottom to sink them to the seabed, and other auxiliary equipment, such as harpoons to haul the animals aboard. All of these implements would have been within the power of the Alepotrypa fishermen to obtain, but none can be expected to have survived to be archaeologically identified. Other types of coastal fishing for pelagic fish are conceivable, namely beach seines and longlines. The size of the individuals caught inshore could vary depending on the season; generally in a single catch fish of the same size would be expected. Desse and Desse-Berset (1994) offer an additional argument in favour of coastal fishing for medium-sized tunas found in Neolithic sites on Cyprus (besides the lack of large individuals), namely the absence of other strictly open-sea fish in the corpus, such as the swordfish or the dolphinfish. The same line of argument could apply to the Alepotrypa material.

Coastal fishing would definitely be a common practice, as the presence of several strictly neritic species suggests. Various fishing methods could be involved, depending on the ethology and size of the fish (Figure 17.13). Various seabreams, groupers, seabasses, mullets and parrotfish may be caught either with nets (gill nets, beach seines, bottom trawling), with various types of lines and hooks (longline, hand line) or with harpoons for bigger individuals. Although most are schooling species, they are not found in numbers that would support a method of fishing on a larger scale or aimed at just one species. The use of hook and line seems more plausible, although a net with a mesh size suitable for most of these species is also possible. More significant concentrations of groupers as found in the Final Neolithic could be the result of a net-fishing technique. At the same time, passive methods, such as traps (for the groupers, parrotfish, some sea breams, mullets and morays) or more dam-like enclosures, if fishing occurred in restricted zones such as river mouths (for the catadromous fish, the thinlip grey mullet and the eel, as well as the gilthead seabream), are not excluded,

although the numbers of these species do not suggest the repeated use of such devices.

The calendar of collecting and fishing activities

The wide ecological range exploited at Alepotrypa Cave, as well as the quantities represented, raises the question of a year-round exploitation of available marine resources. The question lies at the centre of a much-debated issue in archaeology, namely the temporal cycles of cave-site occupation. Faunal and botanical evidence from caves may indeed prove to be key elements in judging the uses of caves at a micro-temporal level (for an overview, Tomkins 2009). Mammal evidence from Alepotrypa does not support a strictly seasonal occupation of the cave, but rather a seasonally more intensive pastoral activity, namely from early winter to late summer (Hadjikoumis, this volume). Comparison of these observations with the fishing calendar may prove particularly interesting. The marine faunal material from Alepotrypa, both by its nature and preservation, offers snapshots into the year-round cycles of collecting and fishing activities. However, any attempt to identify individual catches as opposed to repeated fish-landings within one season or intra-annually will fail because of the wide chronological span of occupation, as well as the limitations inherent in the methods employed (see above; also Colley 1984). Accordingly, the following observations can only offer a broad estimation of the seasonal cycles of marine resource exploitation by the Neolithic inhabitants of Alepotrypa.

As suggested by the ethology of the fish species present, there are generally two broad groups of fish, those that were available on a year-round basis, generally coastal or deeper-water species (sea breams, groupers, mullets, seabasses, parrotfish, morays, sharks and rays), and those that had a more seasonal presence, namely large pelagic migratory species (tunas) as well as catadromous or euryhaline species (some mullets, eels, some sea breams). The same species can thus be naturally found in greater numbers at different times of the year. Apostolidès (1883, 37–38) offers a general calendar of traditional fishing in the 19th-century Aegean, for all types of fish.² Molluscs and other invertebrates also have a yearly life cycle. In the Mediterranean, the absence of noticeable tides allows for a generally year-round presence of most species. However, they usually reach a maximum size during the warm season (Claassen 1986). Generally speaking, these observations are not fixed and need to be interpreted with some degree of flexibility. Several other parameters should be taken into account when studying a fishing or collecting calendar, namely changing weather conditions, temperature and salinity fluctuations, and other physical parameters. For instance, some invertebrates can be more easily located after a storm (Luchesi 2006) or, contrariwise, may be depleted by extreme heat (Claassen 1986). It can be generally inferred that neither fishing nor

collecting of molluscs would take place during stormy weather or in extremely low temperatures.

Other factors of a cultural nature, related to the organisation of fishing and collecting activities, to the fishing methods employed, and the various other activities undertaken by the community, even preferences in taste, may affect the annual calendar of fishing and collecting. In 18th-century Mediterranean tuna-fishing activities (Faget and Sacchi 2014), tuna traps could be set out in February or March and the fishing season would go on to the start of autumn (for modern data on the Aegean, Oray and Karakulak 2004). It would indeed be more rational, especially with respect to Neolithic communities, to prolong the use of these devices as much as possible, especially with a view of increasing the abundant tuna catches. The latter's presence also suggests that these migratory species were indeed available during longer periods of the year than generally thought. Other fishing and collecting methods would probably be more independent of these restrictions. Certainly, the impact of the Neolithic agricultural calendar should also be considered (see also Apostolidès 1883, 39), although traditional coastal communities would conceivably combine multiple activities, as suggested by ethnographic examples (Forbes 1976). Matters of preferences of taste would have also been particularly developed among coastal communities, with their deep knowledge of the surrounding marine resources. Ancient Greek attitudes (Dalby 1996, 71, 166), remaining unchanged until modern times in the Mediterranean (Davidson 2002, various instances), indicate specific times were appropriate for the harvesting of molluscs or fish, depending on how prolific or how tasty they were: several molluscs are thought to be tastier during a full-moon, mullets would be higher in fat contents right after spawning, while summer tunas would not be as tasty as those caught in late September. Such appreciations usually reflect physical properties of marine organisms, depending in turn on the seasons.

A closer understanding of the fishing cycles existing in an archaeological assemblage may be gained by inspecting the incremental growth structures of fish and shells (on the method, see above). As explained above, for the purposes of this study only a fraction of the fishbone material was available, usually the bigger and better preserved vertebrae. Thus only partial information is forthcoming with respect to the marine exploitation strategies. Even so, the studied specimens do offer an interesting overview of the fishing organisation in the two main periods (Figure 17.15). Although the bulk of the fishing activity would take place during summer, both spring and fall catches were quite important in both periods. Occasional winter catches are also present. However, during the Final Neolithic the fishing season seems become slightly more extended in time and would probably go on into late fall. It is almost impossible to refine the dataset further to make a year-to-year

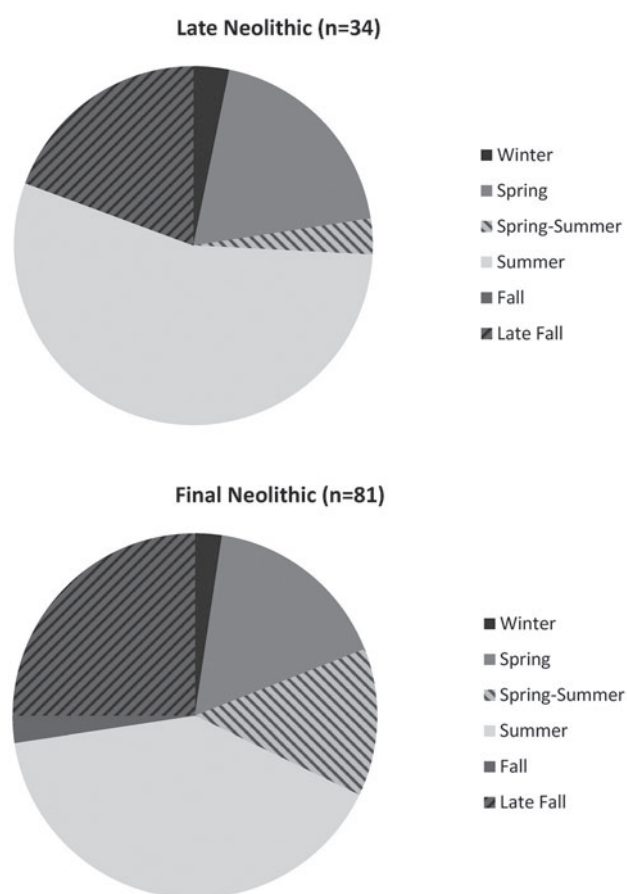


Figure 17.15. Estimated season of capture of fish in the Late and Final Neolithic, based on growth annuli from vertebrae (all species).

comparison of the fishing calendar, as observed above. Additional seasonal data from an upcoming study of selected shell samples is expected to complete the emerging patterns of marine resource exploitation, thus far based only on the fish remains.

Aspects of pre- and post-depositional history of aquatic remains

Once brought on site, the marine harvest was subject to various activities, related to their exploitation, either dietary or other. The hard tissue of shells and fish bones records alterations due to natural causes (water-abrasion, natural perforations), human activity (tool marks, heating, shaping) and taphonomic processes (fragmentation, weathering), all of which may provide important information on the history of aquatic remains, prior and after their deposition in the archaeological matrix (Claassen 1998, 53–54). The following paragraphs offer a suggested panorama of the uses made of marine organisms through the marks left on their remains. An integrated spatial approach further defines potential activity areas related to their exploitation (based on NISP counts of shell and fish remains, grouped by families, Tables 17.3 and 4; see also Table 17.5 on worked shell specimens).

Table 17.3. Spatial distribution of invertebrate remains by families (NISP, in alphabetical order)

Invertebrate families	outside A	A	B	A	Z	AA
Arcidae			2			
Buccinidae	1	1	4			
Cardiidae			4			
Cassidae	1		1			
Cerithiidae			10			
Columbellidae			86		13	4
Conidae			28			2
Cymatiidae		1	12			
Cypraeidae		3	9			
Decapoda			4			
Dentaliidae		2	11		4	1
Fasciolaridae		2	1			
Glycymeridae			1			
Mitridae			1			
Muricidae		4	92			
Mytilidae			2			
Nassariidae			1			1
Ostreidae			1			
Patellidae	2	78	1825	11	2	37
Pinnidae			32		2	
Sepiidae			1			
Spondylidae	1		32	4	73	
Tonnidae			2			
Trochidae	1	17	755	5	7	12
Veneridae			1			
Total NISP	6	108	2918	20	101	57
Total %NISP	0.2%	3%	91%	1%	0.5%	2%

Table 17.4. Spatial distribution of fish remains by families/class (NISP, in alphabetical order)

Fish families (or class)*	A	B	A	Z	AA
Anguillidae			1		
Moronidae		2			
Mugilidae		5	1		
Muraenidae		4			
Rays				1	
Scaridae		5		1	
Sciaenidae		1			
Scombridae	68	119	18	27	7
Serranidae	3	6	1	22	
Sharks	2	24			
Sharks-rays		3			
Sparidae	1	14		3	
unidentified	44	158	2	70	12
Total NISP	118	341	23	124	19
Total %NISP	19%	55%	4%	20%	3%

Marine resources as food: preparation and consumption

The Alepotrypa marine faunal material features a great variety of marine resources destined for consumption, including molluscs, crabs, and fish.

Most invertebrates represented in the assemblage are edible and would have been collected for this purpose, with the exception of a few smaller gastropods or other species collected dead on the beach for their shells (see above). Molluscs may be eaten raw or cooked (Davidson

Table 17.5. Spatial distribution of modified shell specimens (NISP)

Species	A	B	A	Z	AA	not known
Dove shells (beads)		45		7	2	
Cone shells (beads)		2				
Tusk shells (beads)	2	13		4	1	1
Thorny oysters (beads)	1	10		72		
Cowries (beads)	1	2				
Other (perforated)		2		1		
Thorny oysters (annuli)		11		3		1
Other (annuli)	1	1				
Other uses		7		1		1
Total NISP	5	93	0	88	3	3

2002, 189–215). Both methods are conceivable and attested in prehistoric Aegean (Theodoropoulou 2007a). Eating molluscan resources raw offers an advantage, which counterbalances the effort expended in harvesting them. Boiling or steaming of bivalves to help open the valves, or of gastropods to facilitate the extraction of the animal from its shell is the most common preparation method. Although heating of the shells will tend to produce cracked or decolorised shells, it is usually difficult to distinguish these marks from post-depositional alterations of the specimens. The presence of burnt shells usually is the result of a direct contact with fire rather than cooking. Only three specimens among those destined for consumption, including one crab claw, exhibit a direct and prolonged contact with intense fire: this was probably a post-consumption event (throwing the leftovers into the hearth intentionally or accidentally).

On the other hand, the effects of raw consumption on the shell of molluscs may be more recognisable in an archaeological material. A number of marks are related to the effort required to extract gastropods (namely topshells, occasionally purple shells) from their spiral shells in order to consume them. These instances probably indicate raw consumption, as heating or cooking would not have required the subsequent forceful extraction of the animal from its shell. This seems to be a common practice in the Final Neolithic, which produced 22% of topshells with the appropriate marks against only 7% observed in the Late Neolithic. Similar tool marks have been observed on the aperture of a number of cone shells, however their presence does not necessarily betray consumption. The species is generally considered of no value as a food source, but is cooked in some Mediterranean cuisines (e.g., Croatia) and in Asia (Philippines). However, other possible uses might be suggested in connection to the extraction of the animal (see the section on Other uses below).

However, the presence of tool marks remains overall low in the shell material. A more common method of extracting the flesh from gastropods was by fracturing their shells. Fragmentation is quite high in topshells. The study of fragmentation patterns on this species (Figure 17.16) confirms the intentional crushing of individuals (62.3%)

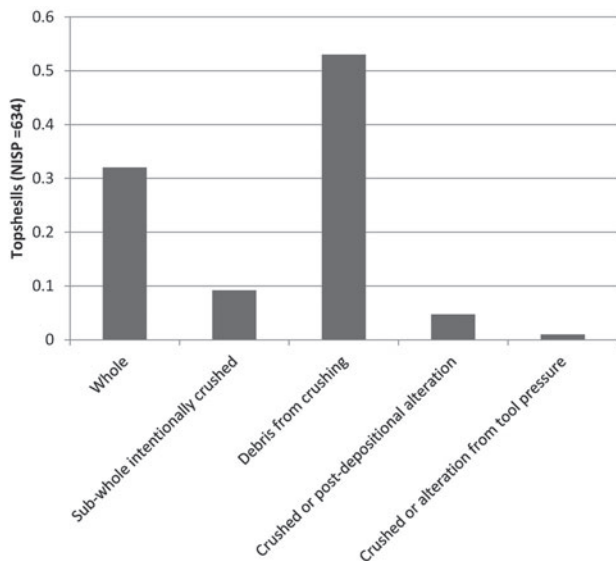


Figure 17.16. Main fragmentation patterns observed on topshells at Alepotrypa (NISP).

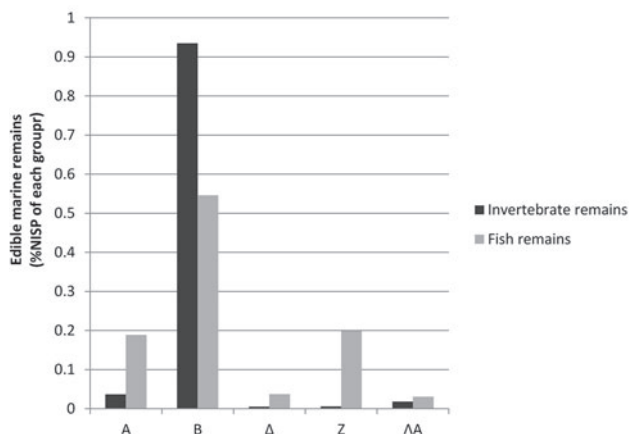


Figure 17.17. Frequencies of remains of edible invertebrate and fish at different areas of the cave (%NISP).

rather than resulting from post-depositional pressures (only 4.7%, localised on the zones of suture of the shell, such as the apex). Whole individuals recovered (32%) would either have been for boiling or awaiting raw consumption. For other molluscs, such as limpets, the shape of their shell makes extraction easy, without force being needed. It is thus difficult to infer the methods of preparation and consumption for these species. The flesh would either be eaten raw or used in some culinary preparation, the ingredients of which remain unknown.

A further insight into the distribution of molluscan foodstuffs, *apropos* consumption and refuse patterns, may be offered through an integrated spatial approach. The bulk of the shell material identified as food remains comes from Chamber B (90% of NISP), with a minor presence in Chamber A (3%), the Chamber of Lakes (2%) and Chambers D and Z (>1%) (Figures 17.17 and 18). Fragmentation rate in Chamber B reaches 41% for the

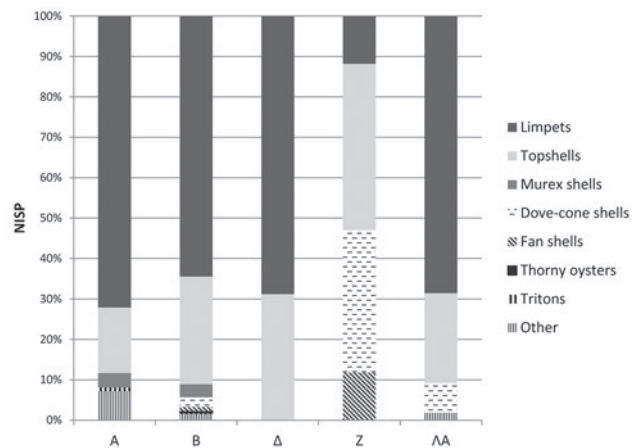


Figure 17.18. Frequencies of shell families in the different areas of the cave (NISP).

two recurrent edible species, limpets and topshells. It drops down to 9% in Chamber A and its outskirts. It may be assumed that most molluscan resources would find their way quickly after collection on the nearby shores to the outermost chambers of the cave, to be then distributed further inside the cave depending on the needs. In such a scenario, Chamber B seems to be a central place for consumption of molluscs, as proven both by the numbers of remains and their fragmentation rate. The ease with which consumption of freshly collected limpets and topshells could be carried out in the most easily reachable and spacious chamber of the cave would probably explain its choice. It also seems that this area was also used for dumping the refuse, which was neither cleaned up nor removed from the cave. A few intact shells found in Chamber A and its outskirts would probably be losses suffered in the transport of molluscs into the cave, rather than reflecting efforts to clean Chamber B. Rather, the minor presence of edible shells in Chambers D and Z needs to be discussed within its wider archaeological context. Chamber D seems to have been intended as a burial ground, while Chamber Z is less clearly comprehensible: mostly it consists of a black matrix composed of animal dung (Karkanas, this volume), with a large number of whole ceramic vessels of different types (Psimogiannou, this volume), as well as animal bones (Hadjikoumis, this volume). The low number of remains would indeed corroborate the special character of these areas, as is supported by other evidence, namely the presence of burials (see Papathanasiou, 2001; for similar conclusions on the out of the ordinary uses of plants in these same areas, see Margaritis, this volume; Tsartsidou, this volume). However, fragmentation in these two spaces is not uniform: it reaches 37% in Chamber D, but drops down to 11% in Chamber Z. If burial or sacrificial activities are to be argued for in these two areas, then the consumption of marine foodstuffs during commemoration meals (D) or the offering to the deceased of the same foodstuffs being consumed by the living (Z)

could be suggested. At the same time, the presence of edible molluscs in the deeper Chamber of Lakes, although far from abundant (49 NISP), witnesses an extremely high fragmentation rate of limpets and topshells (92%); this pattern is of interest. Both species could have been taken into this inmost chamber of the cave and consumed *in situ*. Their fragmentation suggests a deliberate crushing of the shells before or after their consumption. However, the same state of preservation could also be caused by a post-consumption disposal of shells brought here from other areas of the cave. The faunal material does not seem to support the hypothesis of an area dedicated to eating either (Hadjikoumis, this volume).

The fish remains may provide a further insight into the management and consumption of marine resources. This material from Alepotrypa seems to show a different picture than that of the invertebrates, based on its overall spatial distribution (Figures 17.17 and 19). Although fish are again mostly concentrated in Chamber B (55%), Chambers A (19%) and Z (20%) now too yielded a fair number of remains. Chamber D as well as the Chamber of Lakes, on the other hand, contained only 4% and 3%, respectively. The distribution of the species and the parts of fish present may shed light into the specific ways the fish were treated throughout the cave.

All fish species represented in the assemblage are edible. Among them, a great variety of tastes, textures, colours and qualities would have been recognised. The flesh of tunas and mackerels is overall firm, compact, and rather heavy, but different species provide varieties of meat, and different parts are known to be appreciated in different cultures (Davidson 2002, 127). Sharks and rays also have a strong taste and provide firm steaks. Sparids, on the other hand, offer a delicate white flesh, widely regarded as the best among Mediterranean fish. Similar characteristics are found in parrotfish. Groupers and seabasses have a firm, bone-free, delicately flavoured flesh. The flesh and eggs of mullets are also generally

highly esteemed. Snake-like fish present at Alepotrypa, eels and morays, would also be distinctive both by their form and taste, with eels having more fat than most fish and making heavy dishes. The spatial distribution of fish species does not declare that any areas were dedicated to the consumption of specific fish, with the exception perhaps of eels and groupers. All represented species, dominated by tunas and mackerels, have been retrieved from Chamber B, as was the case with the invertebrates. Sharks and rays also come mostly from this area. Scombrids are again the most recurrent family seen in Chambers A and Z, accompanied by a high number of unidentifiable fragments, namely ribs and girdles/fins (possibly also belonging to Scombrids). However, Chamber Z offers an important assemblage of grouper remains, which counts for the bulk of these fish in the cave. Among the few fish found in the remaining areas, the presence of a single eel remnant in Chamber D associated with the human burial is worth noting, because of its particular shape, taste, and texture. In contrast, the single individual specimen in B1a of a similar snake-like fish, namely the moray, is not related to any unusual context.

The diversity of fish as well as of sizes both between different species and among the same species would have certainly involved a range of methods of preparation and cooking, and also conservation. Unfortunately, the material from Alepotrypa offers but few indications for preparation and cooking methods. Only a combination of observations – selected species, sizes, skeletal representation and other possible markers, such as butchery or fire marks, in combination with spatial distribution and potential concentrations of seasonal catches – may give an insight into the methods chosen by the users of the cave.

Processing for consumption and especially for preservation is indeed particularly relevant in revealing significant catches of seasonal resources, such as tunas and mackerels. Identifying preservation processes in archaeofaunal material is not straightforward (for the methodological background and an overview in the prehistoric Aegean, Theodoropoulou 2007a, 2007b). As it has been suggested above (in the section on seasonal aspects of fishing), the cave would be more or less regularly supplied with fish stocks from spring to late fall with a peak of activity in summer. Though the spatial distribution connected to the management of these resources within the cave is quite distinct, it does not, however, seem to be related to varying preservation patterns, but rather to the differential management of different fish species (Figure 17.20). Both outermost areas of the cave, *i.e.*, Chambers A and B, produced samples of catches from most of the fishing annual calendar attested at the site, with the area A being slightly more summer-fall oriented, as opposed to slightly more spring-summer catches in Chamber B. On the other hand, the pattern of both areas contrasts with the two other areas, Z and the Chamber of Lakes, where an observation of growth annuli

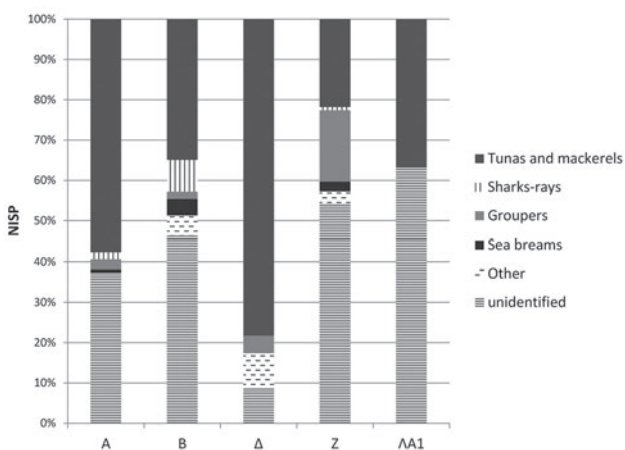


Figure 17.19. Frequencies of fish families in the different areas of the cave (NISP).

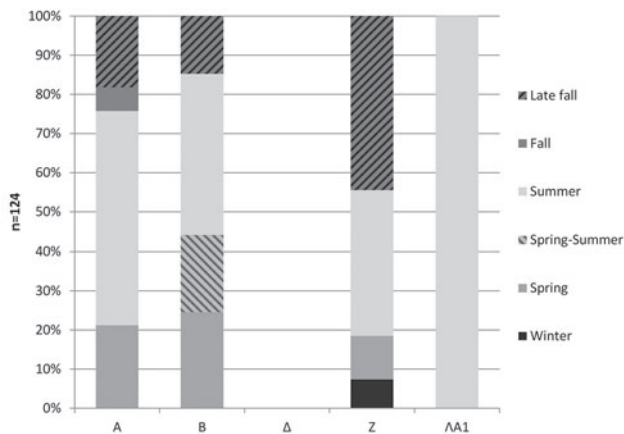


Figure 17.20. Frequencies of seasonal fish landings in the different areas of the cave.

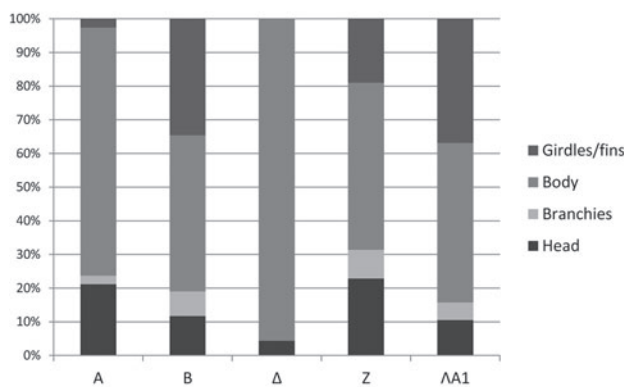


Figure 17.21. Frequencies of different fish anatomical elements in the different areas of the cave.

was possible. The fall-to-late fall stocks in Chamber Z are predominantly the result of specific hauls of groupers found here, the reasons for which remain unknown. The spring and summer catches in the Chamber of Lakes are only based on two individuals of albacore and bullet tuna.

It seems that as a rule whole fish were brought into the cave (for a similar practice observed in mammals, Hadjikoumis, this volume). All body parts, including the easily spoiled head and gills as well as girdles and fins, are present in most chambers, with the exception of area D (see below) (Figure 17.21). Vertebrae are the dominant anatomical unit (excluding unidentified girdles/fins), but this is partly explained by the large numbers these elements exist in fish (usually around 39 in most Scombrids, of which 20 are precaudal and 19 caudal; the count can reach up to 200 in sharks-rays) (Figure 17.22). Some processing for consumption or preservation could have taken place at the outmost Chamber A of the cave, namely the removal of the head and gill area, which were then disposed of outside. The anatomical representation of tunas and mackerels may also offer evidence of some kind of preparation. The higher presence of caudal over precaudal vertebrae (Figure 17.23) in tunas may indicate a preference for the caudal portion. The chopping up of

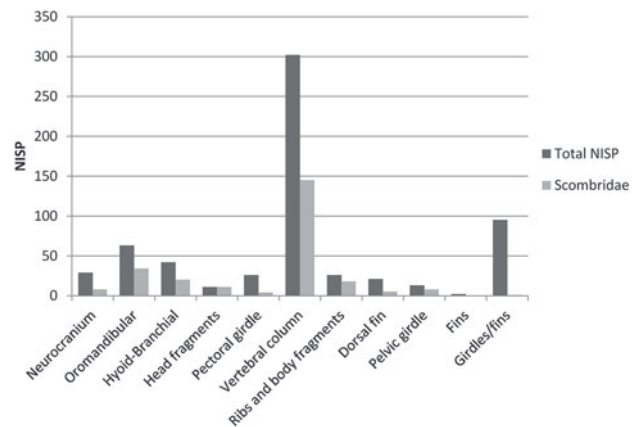


Figure 17.22. Numbers of fish anatomical elements (all families included) and numbers of anatomical elements of Scombrids.

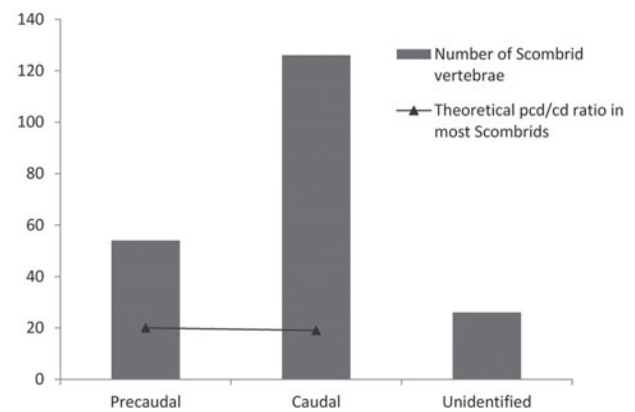


Figure 17.23. Numbers of precaudal, caudal and unidentified vertebrae of Scombrids.

these big fish is further supported by occasional butchery marks: two tuna vertebrae seem to have been vertically chopped through, two more diagonally, while one vertebra bears three vertical parallel incisions. Furthermore, 55 spines and ribs, presumably from tuna due to their large and robust size, are systematically cut on their proximal side. Such cut marks could also be related to slicing actions that would thus have affected these parts of the fish. It is hence possible that caudal tuna chunks were preserved inside the cave, presumably salted, as is actually a common practice in Greece and the Mediterranean. The easy access to salt (still often collected on an individual basis in this part of the Peloponnese) combined with the presence of large pots would fit with such a practice, even if the environmental conditions within the cave are not optimal for any long-term preservation.

Other more vulnerable body parts could have been eaten fresh or could have also undergone some other preservation processing. Other regularly seen fish at Alepotrypa, namely groupers, also seem to have been brought in whole, but there are no indications as to potential preservation. For other bony fish, the numbers of remains are generally too low to suggest any likelihood

of specific preparation/preservation. Shark and ray remains are only represented by post-cranial elements: potentially their heads were removed at the fishing-site. However, such a hypothesis cannot be confirmed by the remains themselves, as the chances of preservation of their cartilaginous cranial elements are low.

A particular insight into the management of fish parts may be garnered from the remains from Chamber D. This area, despite the low number it produced, displays an interesting assemblage, both in terms of species composition and anatomical representation. Three different vertebrae of three different species exist: the single eel (associated with the human burial), a chopped tuna vertebra and a mullet vertebra. One head fragment of a white grouper and a handful of tuna scales complete this rather unique collection. The evidence points to the deposition here of selected slices or fillets of the best fish to be found in the cave. It is, however, impossible to infer whether these parts were selected fresh or salted.

As to the consumption methods of fish foodstuffs at Alepotrypa, no marks exist that infer any specific cooking practices. Various methods and recipes could have been involved: steaming, boiling or grilling, but most would leave no traces on the bones. The presence of sizeable fish, as well as indications of butchering, allow one to suggest the cooking of large tuna chunks either in large pots or in ovens. The complete absence of fire marks (usually to be found on exposed head bones) excludes the grilling of fish, at least the smaller ones, directly on the hearth. On the other hand, some consumption habits of the users of the cave may be visible on the bones: two small vertebrae (bullet tuna, saddled seabream) bore signs of chewing, although it is difficult to distinguish human from animal mastication on these specimens (on frequent animal gnawing of bones in the cave, Hadjikoumis, this volume). A final observation regards the disposal of the fish remains and cleaning of the cave of these food leftovers. The presence of all anatomical units in most parts of the cave rules out any effort to remove them. On the contrary, the presence of various mixed head and body fragments, usually not identifiable as to the species, in the Chamber of Lakes would suggest, as in the case of shells, some disposal in this area of the cave.

Uses of the hard tissue of marine organisms

A number of molluscan remains from the cave are not related to food consumption. Alepotrypa offers a quite abundant record of modified shells, which generally follow well-known, widely spread Neolithic and earlier traditions. They are usually identified as ornaments (Karali 1999; Taborin 2004; Theodoropoulou 2007b; Bar-Yosef Mayer 2005). The following paragraphs follow this generic identification, although occasionally other possible uses are suggested – other strictly utilitarian uses are proposed for a number. Most of these types of remains were retrieved from Late Neolithic Layers, less

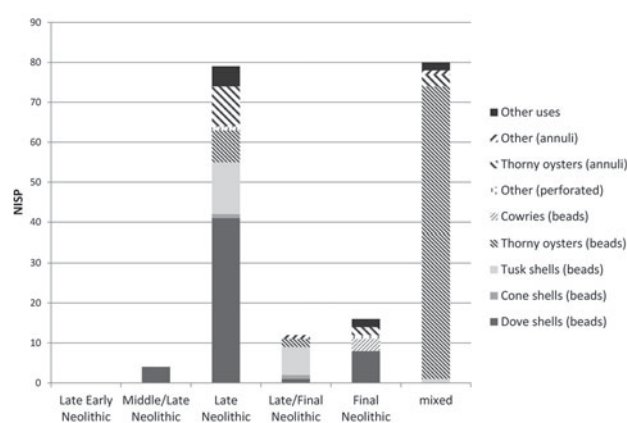


Figure 17.24. Types of modified shells in the different Neolithic phases at Alepotrypa.

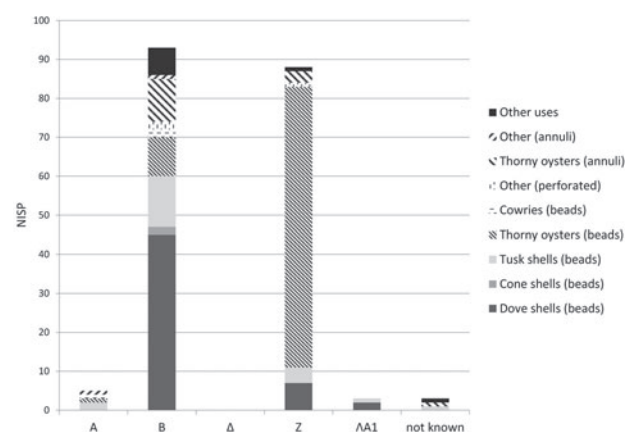


Figure 17.25. Types of modified shells found in the different areas of the cave.

often from Final Neolithic ones, while a single deposit of 77 items was found in mixed Early to Final Neolithic deposits (Figure 17.24). Once again, the bulk of the material comes from Chamber B (90) (Table 17.5). Although Chamber Z seemingly has a similar number of items (mostly from Niche 22), this figure should be decisively reduced as 72 of 90 specimens seem to belong to a single object deposited. Chamber A and Niche 1 in the Chamber of Lakes produced 3–5 such specimens (Figure 17.25). Interestingly, Chamber D did not produce any modified shells.

Two types of modified shells generically called ornaments may be distinguished: a) beads/pendants made from various shells, and b) annuli (rings) made from *Spondylus* valves, with some potentially also from other gastropods.

BEADS/PENDANTS (Figure 17.26 and 27)

Shell beads are the most common of these finds in the Alepotrypa assemblage. This category includes all shells bearing at least one perforation produced by humans, or offering a natural orifice that could have been used for stringing or attaching. They come in a variety of shapes

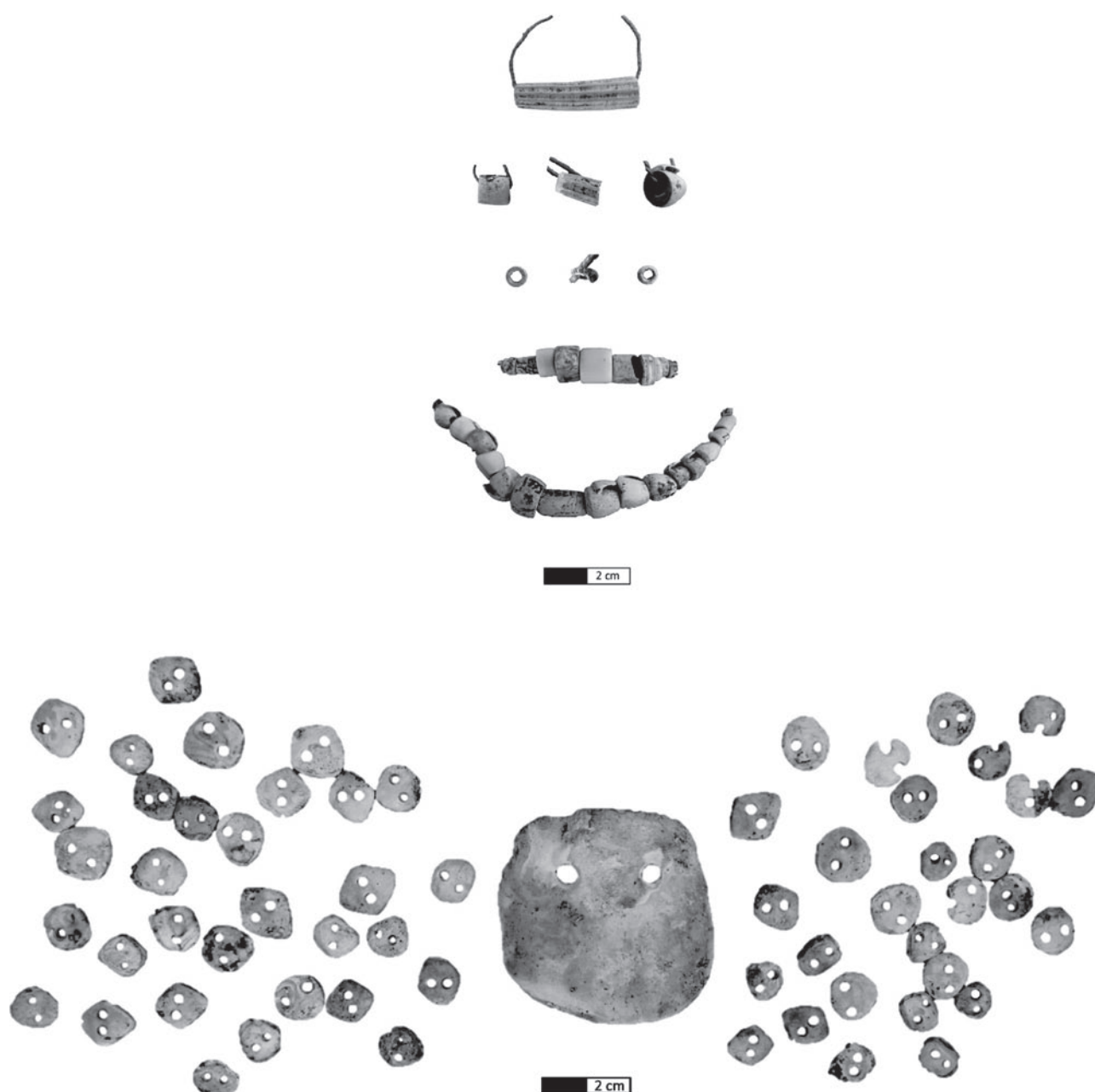


Figure 17.26. Examples of beads/pendants from Neolithic Alepotrypa (© Tatiana Theodoropoulou).

and sizes and are from a variety of shells. Two main groups can be distinguished: items made from *Spondylus gaederopus*, which exhibit a high degree of technological and aesthetic investment, and a second group from various small-sized gastropods.

Thorny oyster (*Spondylus gaederopus*): this group primarily consists of one single assemblage of 72 white, perforated *Spondylus* beads of various shapes, found in Chamber Z in mixed Early to Final Neolithic layers. One of them is significantly bigger than the others (45.2–45.8 mm, 4 mm thick) (Figure 17.26, bottom): a roughly square to trapezoid shape, it bears a double perforation (two little round holes) on its upper part.

The remaining smaller beads (usually 9–12 mm, with a thickness ranging from 1.3 mm to 3 mm, occasionally >3 mm) have the same double perforation, either on their upper part or more centrally placed, but come in a variety of shapes, namely two square to rectangular, 11 oval, 15 in a regular diamond/lozenge shape and another 43 in a more elongated diamond shape. Various techniques would have been involved for their manufacturing: sawing, grinding-down, and perforating. The overall result is technically and aesthetically quite homogenous, and would have certainly been highly esteemed. It remains quite unique both within the cave context and in the Neolithic Aegean. Similar examples found in the Neolithic Balkans have

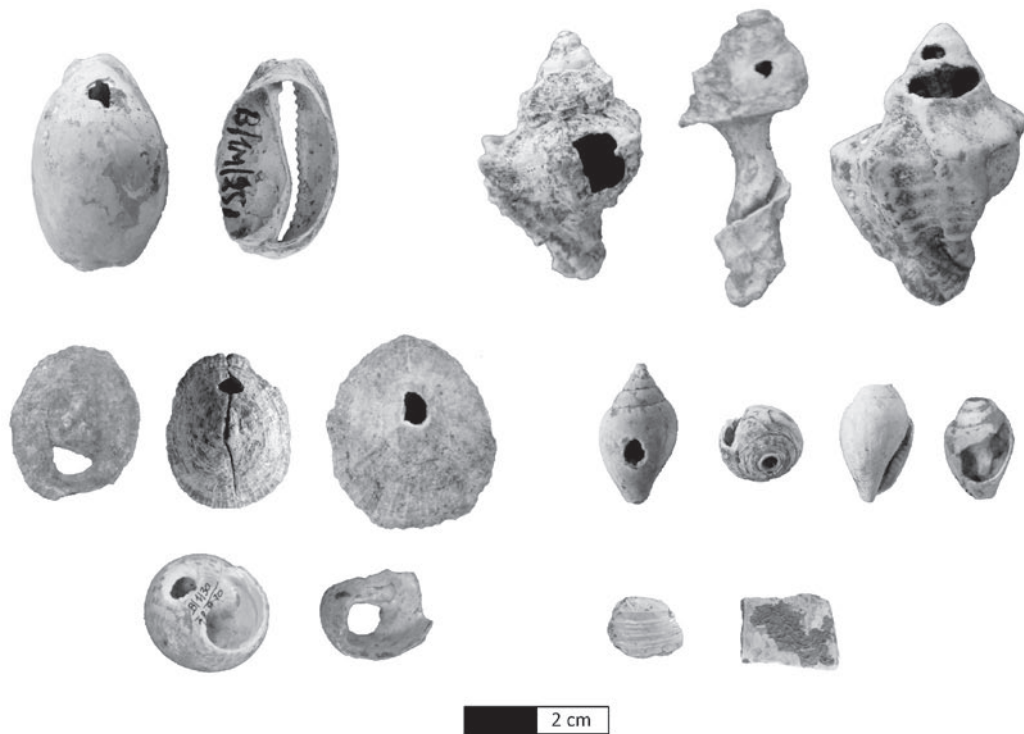


Figure 17.27. Examples of pendants or possible pendants from Neolithic Alepotrypa (© Tatiana Theodoropoulou).

been interpreted as belts (for a reconstruction and various examples Tripković *et al.* 2016, fig. 7).

Spondylus gaederopus has also been exploited for a few more beads (Figure 17.26, middle, arranged together with other beads for the purposes of the museum's exhibition), mostly found in the Late Neolithic layers of Chamber B, including seven small cylindrical beads and two more oblong ones, produced by sawing and grinding to shape; another square piece bears preliminary working for a perforation. Furthermore, other items made from *Spondylus* could have conceivably been pendants (Figure 17.27, bottom): one fragment resembles a bird, probably produced by cutting-down and abrasion, one abraded oblong specimen, one abraded moon-shape item, and one more concave piece with two half-finished perforations on its upper side.

Other shells, usually small-sized gastropods, with little value as a food source, have been used for the manufacturing of beads. Such shells have been used for ornamental purposes both in Europe and in the Levant since the Palaeolithic, usually after receiving some degree of modification. The specimens found at Alepotrypa Cave are usually worn, thus indicating they were collected as empty shells on the seashore; they bear some kind of modification. Three main shell species are involved; a few other shell species were potentially modified too into pendants.

Dove shells (*Columbella rustica*): of the dove shells found at Alepotrypa, half are worked (54/103 NISP). They mostly come from the Late Neolithic layers of Chamber B, while seven more were found in Late and Final Neolithic layers of Chamber Z and two more in Final Neolithic layers of the Chamber of Lakes. Most of the individuals had been collected dead on the beach (49 worn). 39 specimens were sawn at both ends (apex, siphonal canal) and three more abraded in the same areas, in order to acquire a more or less cylindrical shape (Figure 17.26, middle), while less often (12 specimens) only the siphonal canal was removed. Two failed examples of dove shell beads indicate that manufacturing would have taken place inside the cave. This opinion is supported by the presence at the site of another 49 unworked dove shells, which were probably awaiting modification. One of the specimens found in Chamber Z is almost calcined (resulting in a blue-grey colour), but it is not certain whether this was due to an intentional burning or an accidental result produced by other events that took place in this area, namely related to sacrificial and burial rites. Two dove shells bear an artificial hole on their dorsal side. Other examples are missing the apex, probably due to water-abrasion, but presumably they have been collected to be used as ready-to-string pendants (Figure 17.27, second row right).

Cone shells (*Conus ventricosus*): among cone shells from Alepotrypa (30 NISP), only two specimens, both from Chamber B (dated to Late Neolithic and to Late/

Final disturbed layers), may have been used as ornaments (on other uses of *Conus*, Reese 1983). One bears a perforation on the apex, probably produced by natural wear, and may have been used as pendant (Figure 17.27, second row right). The second one has been sawn down on the siphonal area, and thus given a shape similar to the one found in dove shells. However, it is interesting to note that, despite the resemblance of the two species and the environmental availability of both, cone shells are not preferred over dove shells for bead production, thus implying a human choice beyond the purely aesthetic, potentially linked to specific symbolisms attributed to various shells.

The issue of such symbolism linked to specific shell shapes is a much-debated matter, also raised with respect to another shell, often found at Alepotrypa, the tusk shell.

Tusk shells (*Antalis* sp.): this group is the only one to be found in almost all areas of the cave, even if in different numbers (13 from Late Neolithic layers of Chamber B, six more from Final Neolithic layers of Chambers A, Z and Niche 1 in the Chamber of Lakes). The assemblage mostly includes shells worked into beads (19), as well as two 'unworked' examples (Figure 17.26, top and middle, arranged with other beads). It is possible that the latter were actually used as beads thanks to their shape and natural perforation, as one of them bears on its surface signs of wear from stringing. This shell offers a naturally white bead, with a rippled or smoother surface depending on the species, and is found in various sizes. However, at Alepotrypa most specimens are not found intact, but are sawn at both ends into various lengths, from fine cylindrical to more elongated bead shapes. It is hence possible that one single individual shell could produce several beads, thus maximising the exploitation of this raw resource, but also making it available to more people, as it has been suggested with respect to *Dentalium* beads in Levantine contexts by Bar-Yosef Mayer (2008). As in the case of *Spondylus* beads, the frequency of items from tusk shell from Alepotrypa remains quite unique among Aegean contexts, while they seem to enter a mostly Balkan Neolithic tradition (Tripković *et al.* 2016).

Cowries (*Luria lurida*): a total of 12 cowries were found at Alepotrypa. They were retrieved from both Late and Final Neolithic layers of Chamber B, occasionally Chamber A, while one specimen comes from the late Early Neolithic area of Ossuary I. Three of them bear artificial holes, although not in a recurrent pattern (one with three round holes on the dorsum, one with a big oval hole on the dorsum, one with one small hole on the side) (Figure 17.27, top row left). Thus they are more securely identified as pendants as well as beads. The remaining specimens include five cowries with a missing dorsum, one whole and two more as fragments (Figure 17.27, bottom). Although no specific or intended modification emerges from the study of the cowries at Alepotrypa, it is possible that the various specimens represent different phases in the

transformation process from unmodified to completely ground-down shells. Most of the worked specimens can be attached to a surface or strung.

Purple shells (*Hexaplex trunculus*): although several Murex shells bear holes (Figure 17.27, top row right), most are linked to the forcing of a pointed instrument into the robust shell in order to detach the flesh. Nonetheless, one specimen bears a neat round hole of human origin on its biggest whorl, which could have been used for stringing.

Limpets (Patellidae): several limpets bear a hole on their apex, usually caused by natural wear. However, at least one specimen may bear a hole of human origin on its apex, and two more bear a hole on their whorl (Figure 17.27, second row left). Both natural and artificial holes could have served for stringing limpets.

Topshells (Trochidae): occasional holes on whole or fragmented topshells, as well as one inner pearly part of a topshell, with a round shape, suggest at least an occasional use of this food resource for its shell (on possible uses, Reese 1984) (Figure 17.27, third row right-left).

Fan shells (*Pinna nobilis*): two fragments of fan shell may have been used as ornaments (Figure 17.27, third row right). One *Pinna* fragment from Final Neolithic in Chamber Z (Niche 22) has a bird-like shape and might have served as a pendant if strung at its narrower point. Another, perfectly square, pearly fragment might have been destined as bead, either after perforation or directly attached to a fabric.

Other examples of shells potentially used as pendants, with the help of a string attached around them, include naturally curved and rippled lips of *Semicassis granulata* (see, also their use as annuli in next paragraph) and a sizeable fragment of *Charonia tritonia* (Figure 17.27, bottom; Figure 17.28).

The use of shell-beads at Alepotrypa Cave, as a whole, needs to be further addressed in a special study devoted to the uses of ornaments, and placed within the wider Neolithic context of shell ornament use. What may be briefly concluded here is a clear choice on the part of the Neolithic people of Alepotrypa for specific shells, certainly in part facilitated by their environmental availability, and by their almost ready-to-use shape. Modification of the selected species was easily achieved. At the same time, this choice could have also been directed by other criteria, namely a symbolism based on their shape. The combination of two recurrent species here, dove shells and tusk shells, is found elsewhere in prehistoric contexts: it has been associated with a resemblance the shells bear to the female and male genitals, respectively (Barton 1991; Biggs 1963, 1969, commented on by Bar-Yosef Mayer 2008; Fischer 1949; Joleaud 1935). Other authors find a gender-related symbolism behind the combination of tusk shells and thorny oysters in Neolithic burials from the Balkans (Séfériadès 2000). Shells can be generally related to fecundity, as the cowrie demonstrates (Claassen 1998, 204; Fischer 1949; Germain 1924). As to the specific use

of the beads, their shape and size offers the possibility of stringing them into a necklace, of attaching them to clothes, or simply placing them as decorative elements on the bodies of the deceased, arranged with other shell or bone ornaments (Álvarez-Fernández 2008; Bar-Yosef Mayer 2008; Bonnardin 2012, 31). The use of dove shell beads as decorative elements on garments is arguably supported by various contextual and microwear evidence from a number of Italian and Balkan prehistoric sites (for an overview, Cristiani *et al.* 2014). On the other hand, there are ethnographic examples of small gastropod shells doing duty as money or a unit of exchange (Bocquet 1998; Moss 1993; Pétrequin 1984, 93; Woodford 1908).

ANNULI (Figure 17.28)

The term is used in modern research to simply describe the objects by their shape, which, depending on their size, material, context and other criteria, could have been used as bangles, rings, anklets, pendants or ornaments of some sort (Miller 1997, 217). The most recurrent species used for the making of these items is *Spondylus gaederopus* (for an overview and numerous examples in the European Neolithic, see Ifantidis and Nikolaidou 2011). This group

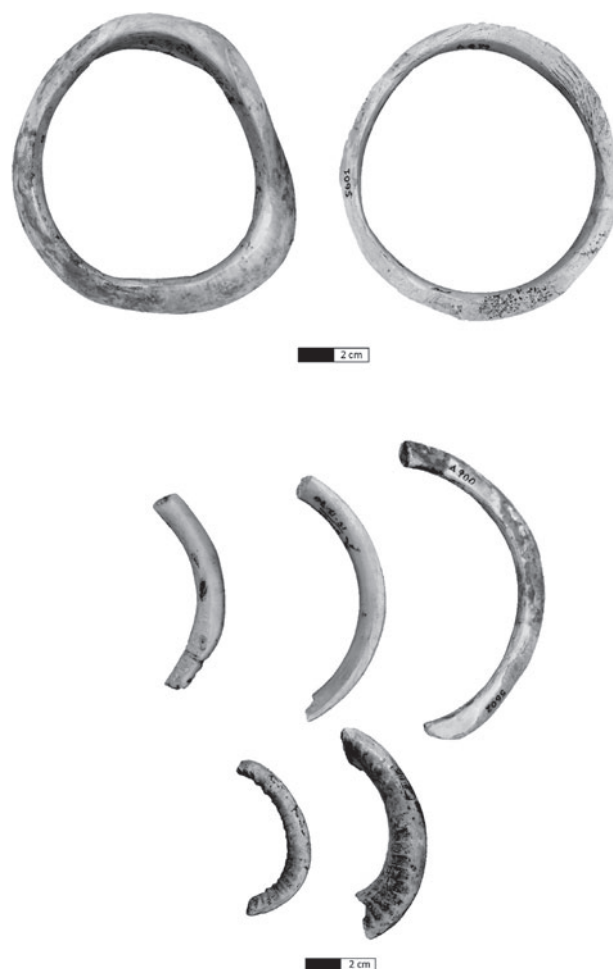


Figure 17.28. Examples of annuli from Neolithic Alepotrypa (© Tatiana Theodoropoulou).

is represented at Alepotrypa with 18 items (Figure 17.28, top and middle): far less abundant than beads/pendants, it yet includes a few prominent examples. As is the case with beads, most come from the Late Neolithic layers of Chamber B, while three were found in mixed Early to Final Neolithic layers in area D. The examples include two intact and several partial annuli of various diameters, from small (39 mm across) to bigger (88 mm across) ones. They usually follow the natural shape of the valve, after the removal of its inner part. Most would have been collected dead on the beach. They offer a variety of cross-sections (square, triangular, elliptical) and are often highly finished, either by abrasion or polishing, hence presenting a marble-looking surface, but they sometimes preserve the reddish/orange colours of the outer surface of *Spondylus* valves. At least one specimen from Alepotrypa was incised (Figure 17.28, middle row left), either for aesthetic reasons or in order to facilitate the attachment of a thread, while two more preserve shallow notches, possibly created by wear generated by repeated use of a thick thread.

Two further examples fashioned from the naturally curved and rippled lips of *Semicassis granulata* could be potentially included among the group of annuli (Figure 17.28, bottom). Their use either as bracelets, with the addition of an attachment to bind the two ends, or as pendants, also attached to a thread, is possible.

OTHER USES OF THE HARD TISSUE (Figure 17.29)

Various utilitarian objects made from shell are known from the Neolithic Aegean (for an overview, Theodoropoulou 2007b). Alepotrypa offers only few examples of such transformed marine raw material, the shapes of which point to a more utilitarian use, although the latter is not always easy to discover.

Among these objects, the most emblematic object remains a single hook-shaped, highly polished, well preserved item made from *Spondylus* (length: 11 cm, width 8.5 cm, thickness 1.1–1.4 cm) of unknown stratigraphical provenance (old Petrocheilos excavations) (Figure 17.29, top row left). This is indeed one of the most discussed shapes of objects made from shell (for an overview and bibliography, Ifantidis 2006). The Alepotrypa example is to be added to the few similar artefacts from Neolithic sites in Greece (Dispilio lakeside settlement, Ifantidis 2006, according to the latter possibly also from Phthiotic Thebes in Theocharis 1973, 332 and Franchthi Cave, Miller 1997, 165, fig. 22/FV429). The functional use of these objects remains quite obscure in previous bibliography from Greece. Due to their distinct shape and important size they have formerly attracted several interpretations, usually decorative and/or symbolic ones. Their general resemblance to V-shaped objects made from *Spondylus*, found in Neolithic burial sites from Central and Western Europe and interpreted as belt buckles (for related bibliography and interpretations see following paragraph), has urged specialists to think of a similar use

for the examples from Greece (Ifantidis 2006; Miller 1997, 286). However, the shape of intact items from Alepotrypa and Dispilio does not but vaguely remind the V-shape suggested for European examples, and rather have a U-shaped central part and artificially pointed ends (*cf.* with object from Alepotrypa made from mussel, following paragraph). The item from Alepotrypa has been interpreted (Papathanassopoulos 2011, 218) as an implement of a shepherd's crook, transformed into a symbol of wealthy farmers and, gradually, into a prestige symbol of general authority – hence its interpretation by the excavator of the site as a 'sceptre'.

During this study, I chose instead as closer parallels to this group of finds, including the item from Alepotrypa, numerous ethnographic and archaeological examples from the Pacific ocean, among other regions of the world with similar items, of actual fish hooks made from shell (to state some, Carlier and Conte 2009; Graves and Elroy 2005; Jameson 1967; Ottino 1992; Sinoto 1991). The efficiency of such a shape and selected material in fishing, especially for larger and fast-swimming species, is diachronically testified in that region, where fishing played a central role in subsistence. The latter seems to fit nicely the sea-oriented community of Alepotrypa, and the same could be suggested for the Franchthi one as well as lake-oriented Dispilio, where large quantities of quite sizeable fish were exploited (see, respectively, on tuna-fishing at Franchthi, Rose 1995, and forthcoming publication; on large catfish catches from Dispilio, Theodoropoulou 2007b; 2008).

However, a couple of elements need to be considered with respect to the find from Alepotrypa, namely the perfect, almost unworn state of preservation, as well as its singular presence. Papathanassopoulos' suggestion, as poetic as it may seem, if transposed into the world of fishermen, given the seemingly central role of fishing/collecting activities in the area, as well as the important catches of large migratory species, it would be tempting to suggest a symbolism related to fishing for this hook. If we assume that this item has never been used in real fishing activities, perhaps it could represent a hook totem, held by the eldest fisherman, or the leader of the fishermen's group, or it could be attributed to the most competent one as a token for an exceptional catch.

Another object from Alepotrypa, namely a worked mussel valve with a V-shaped notch on its edge seem to fall indeed into the previously discussed group of V-shaped finds from Neolithic Europe. Although this specimen comes from the Petrocheilos excavations and bears no exact location, it is quite unique in the Aegean. Similar examples made from *Spondylus* have been found in Neolithic Balkans (for example, Pavuk 1972), and are commonly found in Linearbandkeramik burials of central and western Europe (Bonnardin 2009, fig. 152; 2012; John 2011; Nieszery and Breinl 1993, 432; Jeunesse 1997, 80). They are commonly described as 'V-Klappe', 'notched' or 'entaillés'. Usually



Figure 17.29. Examples of other objects made of shell from Neolithic Alepotrypa (© Tatiana Theodoropoulou).

placed near the waist of the deceased, they are thought to have served as belt buckles. Use wear analysis also seems to support the aforementioned hypothesis. However, other uses, as spatulas or other utilitarian purposes, including some use related to fishing, could be suggested.

Few other objects made from shell point to a purely utilitarian use (Figure 17.29, top and middle). Two large, concave and leaf-shaped fragments of *Charonia tritonis* have been perhaps used as scoops or plates, while further unmodified examples of helmet shells and other types of

tritons could have served for the same purposes. A similar use may be supposed for one *Spondylus gaederopus* valve, given a rectangular shape and preserving cut marks in its concave side. One more *Spondylus gaederopus* was shaped to a point and could have served as a tool. A similar shape is found in other shell fragments, namely a helmet shell as well one limpet deliberately worked to a point on its anterior side. They could have served as perforators. One fragment of fan shell was given a roughly triangular shape and could have been used as inlay.

Finally, a special note needs to be made with respect to an assemblage of 55 spines and ribs, often bearing cut marks on their proximal side, and originally identified by the excavators of the site as bone needles/piercers due to their pointed distal end (Figure 17.29, bottom). Although the position and type of marks suggest butchering rather than intentional cutting and their pointed shape is definitely natural, yet their size, shape and relative robustness do not entirely exclude their secondary use as sharp instruments.

OTHER POTENTIAL USES OF MARINE ORGANISMS

When recording the non-dietary uses of marine resources in archaeological contexts, the potential uses of the soft tissue of these animals may easily escape us, as it rarely leaves traces on the preserved hard tissue, or any such are hard to interpret. Other invertebrates, such as sponges, will usually leave no archaeological remains to suggest their exploitation.

One potential use of the soft tissue of invertebrates at Alepotrypa is here discussed with respect to specific marks left on the surface of *Conus ventricosus*. Five specimens of this species have a broken lip. The dietary use of this mollusc is probably to be excluded, and this type of mark cannot be tied in to an ornamental use of the cone shells. Other explanations must be sought to explain this fragmentation pattern, but their relatively random spatial and stratigraphical distribution does not suggest an organised activity (four individuals were retrieved from B1A/D-B1Γ-B1Z dated to the Late Neolithic, one individual retrieved from Niche 1 of the Chamber of the Lakes, dated to the Final Neolithic). Fracturing of the lip could have occurred during the removal of the living animal from its shell in order to empty and clean the latter, to be used as raw material for ornaments. However, the flesh could have been extracted either to prevent consumption or to be used for other purposes. The genus *Conus* spp. is known to contain a toxin that can affect the nervous system of the collector, if stung or in prolonged contact. This is the case with larger Indo-Pacific species. The Mediterranean cone (*Conus ventricosus*), on the other hand, although containing this venom, is harmless to humans and there are no reported cases from the Mediterranean linking this mollusc to paralysis or other fatal effects (Turk 1999). Modern pharmacology also has investigated the toxic peptides of the cone shell to produce

pain-killing drugs (Spiezia *et al.* 2014), but it is doubtful that the method of isolating the substance was known to Neolithic populations.

Discussion

Marine animal resources seem to have played a central role in the everyday life and beliefs of the visitors to Alepotrypa Cave. This statement is supported not only by the significant numbers of marine animal remains retrieved from the site, as well as by the great variety of ways the harvesting of the sea was managed, but also and most of all by the manifold expressions of how the marine resources were an integral part in the utilisation of the cave.

The constant visual contact with and proximity of the cave to coastal and marine environments must assuredly have played a role in developing such a wide-foraging strategy of coastal and marine animal stocks. At the same time, among the diverse resources available, various and varying choices are highlighted, which, in turn, reflect a range of exploitation strategies and degrees of communal engagement in the collecting and fishing activities. Although the long stratigraphical sequence at Alepotrypa makes it nigh impossible to investigate matters on a small or intense scale, what seems to emerge from the study is a quite focused investment on the most profitable resources found in the immediate coastal, near-shore and open-sea environments. Even though a large variety of species were collected or fished for throughout the period of use of the cave, the inhabitants of the Diros area developed a quasi-specialised activity of harvesting limpets and topshells on the upper levels of rocky coasts of their immediate environment, and a significant investment in tapping into migratory fish resources. Although these two activities are seemingly quite dissimilar from each other and would have involved mostly distinct technological and organisational investments, they have in common that they both aimed at maximising the returns of harvesting/fishing expeditions, either through easy access to shell beds and in collecting methods (in the case of limpets and topshells) or by investing in a more elaborate method of fishing with greater returns (in the case of tunas and mackerels). One further activity seems to have taken place at a more or less organised level, namely the collecting of dead shells on the beach, potentially at some distance from the site, destined for non-dietary uses. At the same time, the Diros community did not hesitate to fish or collect, in a less formalised way and regardless of the returns, whatever marine resource might have appealed to them. These observations reflect a community highly familiarised with the various marine resources available and ready to engage at different levels and various instances, even though a number of other subsistence activities would have also occupied much of the cave's daily and yearly rhythms (Hadjikoumis, this volume;

on the combination of terrestrial and coastal activities, Forbes 1976). One should imagine different age-groups (adults, elder adults and children) and genders (men and women) being involved in these activities, people with a great capacity for collaboration and organisation, especially with respect to larger-scale harvesting or fishing activities, which would take place from spring to fall. The social organisation required for these activities should also extend to various fishing-related tasks, such as net-mending, as well as post-capture management (cleaning, drying, salting) of important fish catches.

In this respect, Alepotrypa seems to follow a Mesolithic and Neolithic pattern observed in a number of central-eastern Mediterranean coastal open-air or cave sites, where fishing and collecting would play an increased role in subsistence activities. Harvesting for shellfish is attested in several prehistoric sites across the Mediterranean, where limpets and topshells are sometimes collected in important quantities, while cockles are preferred at sites near brackish environments (for an overview of Mediterranean sites, Colaninno *et al.* 2011; Bar-Yosef Mayer 2013, for an overview of Aegean sites; Theodoropoulou 2014). Within the specific cultural context of cave occupation, a number of sites are clearly oriented towards coastal molluscan resources (Cave of the Cyclops, Karali 2011; Franchthi Cave, Shackleton 1988; Grotta dell'Uzzo, Compagnoni 1991; Riparo Blanc, Taschini 1964). However it should be noted too that several other published Neolithic cave sites fall far short of attaining the degree of exploitation of marine resources observed in the cited examples. The exploitation of edible molluscs at Alepotrypa would then certainly have been dictated by environmental availability and facility of collection, but the significant quantities of the collected species would definitely suggest a deliberate choice on behalf of these prehistoric communities to systematically include these resources in their diet.

Published ichthyofaunal evidence from Mediterranean and Aegean sites also occasionally supplies evidence of such sea-oriented communities. Two distinct exploitation patterns seem to prevail with respect to prehistoric fishing strategies (for an overview within these periods, see Desse 1987; Van Neer *et al.* 2005; Bar-Yosef Mayer 2013; for an overview in the Aegean, Mylona 2014). The first indicates the importance of coastal and near-shore fishing, namely of groupers and sparids, occasionally triggerfish and sharks/rays (Atlit-Yam, Galili *et al.* 2004; Grotta della Serratura, Wilkens 1993; Grotta dell'Uzzo, Cassoli and Tagliacozzo 1995; Khirakitia, Desse, 1984; Desse and Desse-Berset 1989; Shillourokambos, Desse and Desse-Berset 2011, on fishing of groupers in the Mediterranean prehistory Desse and Desse-Berset 1999). The second exploitation pattern is more oriented towards the fishing of seasonally available resources, namely tunas and mackerels, with annually available resources continuing to be largely exploited. Alepotrypa seems to fall within this latter exploitation scenario. This tradition is to be found

already at the site of Cape Andreas-Kastros in Cyprus, dated to the 8th millennium cal BP. The assemblage there is largely oriented towards Scombrids (36.5% of a total of 6,000 bones), although coastal fishing of sea breams as well as triggerfish is equally important (28% and 8% of NISP) (Desse and Desse-Berset 1994). In the Aegean, Mesolithic Maroulas also provides evidence of an important exploitation of both migratory (28.5%) and year-round available, mostly inshore fish (23.7% sparids, 16.2% morays, 8.7% groupers, and minor taxa) (Mylona 2010). Tunas prevail over other fish taxa in the Mesolithic layers of the Franchthi cave, although inshore fish such as sea breams and barracuda are also quite abundant (Rose 1994, 434–437). Tunas at this site decrease considerably during the Neolithic, both in numbers and sizes. A similar shift is observed in the Cave of the Cyclops in the Sporades, where a quite important Mesolithic exploitation of migratory fish (14.2%) falls to 8.7% in the Early and Middle Neolithic layers, in favour of a variety of coastal taxa (Mylona 2003; 2011; Powell 2003; 2011).

What seems to be a common observation through all the examples, and is also valid for Alepotrypa, is the considerable amount of marine animal flesh that would reach the sites, potentially over a short period of time as a result of the seasonally more abundant resources. Marine animal contribution needs, of course, to be addressed within the overall animal-based diet. Stable isotope analysis from the site suggests a predominantly terrestrial C3 diet, with little evidence for marine input (Papathanasiou *et al.* 2001). In this plant-oriented community, domestic animals apparently form the core of the local diet, with a minor contribution of wild game (Hadjikoumis, this volume). However, the quantities of marine resources retrieved and the assumed marine dietary input, especially with respect to large and fatty fish like tunas, point to a more important consumption of marine foodstuffs than the one suggested by the aforementioned lines of isotope analytical evidence. The proximity of the cave to the places of collection and fishing at Alepotrypa would have facilitated regular and immediate landing of freshly harvested molluscs and fish. Although stratigraphical limitations do not allow for a refined approach to tracing consumption events, marine remains have been retrieved throughout the long occupational history of the cave and argue for a regular contribution of these resources to the local menu. Environmental availability is, however, only one of many possible reasons for the pronounced presence of marine resources at Alepotrypa. Compared to a terrestrial-based diet, the economic, nutritional, gustative or other criteria that combined to give certain marine resources a regular place among other animal foodstuffs are difficult to assess, but they do betray deliberate decisions made as to species choice, preparation and consumption.

The management and consumption context of such abundant marine food stocks are central to the discussion. Spatial evidence from shell remains suggests that most

invertebrate resources would have remained in the outermost chambers of the cave, especially in Chamber B, where they were consumed. Fish, even bigger ones, would also arrive whole at the site: anatomical analysis suggests that they underwent some preparation, at least removal of the heads and gills, inside the cave, but the form of any preservation carried out cannot be ascertained based on anatomical evidence. Fish were distributed across the different areas of the cave according to need. Broadly speaking, Chamber B acts a central area of management, consumption and possibly disposal of marine resources. This area features the whole spectrum of identified fish and invertebrates. Moreover, it has yielded the bulk of the modified shells. This observation probably underlines the intentional deposition that took place in this area. The specific context of these episodes in Chamber B should be discussed in the light of all available archaeological data. What the pattern of the marine remains seem to imply is a more communal participation in the consumption of important quantities of freshly caught invertebrates and especially larger fish, which were probably not reserved for further, or at least long-term, preservation.

Despite this seemingly homogeneous spatial and functional pattern of marine resources, various evidence suggests that a much more complex approach to the marine world existed. The choice to include specific resources in the Neolithic menu of the cave constitutes a special trait by itself. Moreover, the association of marine animals with non-subsistence events within the cave, as well as the various transformations of marine raw materials, suggest that these animals had connotations at various levels of human expressivity and carried relevant meanings. The association of cuts of fish with burial-related events (Chamber D) offers one such snapshot of the use of these resources beyond subsistence. Most telling in this respect are the numerous modified shells. It is proposed that most of these specimens were specifically sought after and collected on the shores for the purposes of transformation and ultimate use. The latter is not always easy to be clear about within the mixed occupation/burial context of the cave. Most of them are not related directly to burials, but rather found rejected along with food and other waste. Although present in relatively important numbers, modified items come down to only a few groups of shapes/uses, predominantly as beads and annuli. The obvious effort to increase the numbers of the bead-like items (suspended, sawn, or other) seems to suggest a desire to make them more available, although it remains extremely difficult to know whether increased numbers would mean more individuals shared and used these apparently consequential objects, or whether fewer people gathered them in greater numbers. Annuli, as well as the unique hook-shaped object, on the other hand, do proclaim a much more selective, almost elite, use of these objects. Although occasionally more utilitarian uses are suggested by a few other modified shells, the latter are much less common than

in other Neolithic contexts (Theodoropoulou 2007b). This situation may further reinforce the idea of well-thought out and clearly defined principles and meanings underlying the use of the two dominant groups of transformed shells. The values underlying the natural shapes of the raw materials chosen or created later by working, let alone the degree to which customary appreciations or symbolism were attributed to them – all can only be hazarded at. Whether the *marine* origin of these items further contributed to the choice criteria is yet more opaque.

Conclusions

The history of Alepotrypa Cave is certainly multidimensional and not easily discernible. Among the various activities and events that took place within the cave, the marine world played its part in numerous ways. The close practical connection to the sea is more than obvious in the manifold and recurrent exploitation of the coastal and marine environments around or at some distance from the cave. The communal engagement with the sea, both for the harvesting and for the consumption of its fruits, is a common feature throughout the long occupation of the site. Even clearer is the thoughtfulness underlying both of these aspects, through precise choices regarding species gathered, and their management, uses and transformations. All point to a community that had progressed beyond the concerns of basic subsistence to the adoption of a consciously selective marine way of life, expressed at various levels and in various realms.

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Notes

- 1 Estimations of the fish bone material are based on NISP counts, which inevitably do not offer a direct estimation of MNI. In order to minimize this distortion, unidentified specimens were excluded from the counts.
- 2 In January, they fish the saddled bream, the shad, the dentex (...). In February begin the horse mackerels, the bonitos but especially the pompanos (...). In March they fish any species of mullets: at that time, these fish enter the Missolonghi lagoons and the Agoulinitza swamp (...) [n.n. in another passage, Apostolidès mentions the abundance of school shark during this month]. The months of April and May are the most suitable for fishing: all the deep-sea fish close to shore to spawn, scombrids, jack mackerels (...). In June begins the regular fishing: in the beginning of this month the tuna-fishing and in late-June and the beginning of July fishing of jack mackerels, chub mackerels, sardines, etc. (...). In July, they continue fishing for these fish. From 6–18 August to 15–27 September, fishing activities are in regression. It is believed that the waters of the seas become acidic during this time and destroy the nets. What really happens during this season is that due to the high temperatures fish retreat to deeper waters, but at greater depths fishing is not lucrative. A more pertinent reason is that this season is dedicated to fruit-harvesting. It is also the time of grape harvest, and as every fisherman owns a vineyard, they prefer to stay at home (...). After the 15th or the end of September fishing restarts with bogues, gurnards, common pandoras, as well as small sardines, which were migrating in the beginning of June. The same month they also fish for garish, passing off the northern Sporades, until the end of November. In October, depending on the year, appear the skipjacks, chub mackerel and stargazers. These same fish and other less abundant ones continue to be caught in November and December.

Bibliography

- Álvarez-Fernández, E. (2008) The use of *Columbella rustica* (Class: Gastropoda) in the Iberian Peninsula and Europe during the Mesolithic and Early Neolithic. In M. Hernández Pérez, J.A. Soler García and J. A. López Padilla (eds) *V Congreso del Neolítico Peninsular (Alicante, 27–30 noviembre 2006)*, Museo Arqueológico de Alicante, 103–111. Alicante.
- Apostolidès, N. C. (1883) *La Pêche en Grèce. Ichtyologie, migrations, engins et manières de pêche, produits, statistique et législation*. Athens.
- Bar-Yosef Mayer, D. E. (2005) The exploitation of shells as beads in the Palaeolithic and Neolithic of the Levant. *Paléorient* 31, 176–185.
- Bar-Yosef Mayer, D. E. (2008) *Dentalium* shells used by hunter-gatherers and pastoralists in the Levant. *Archaeofauna* 17, 103–110.
- Bar-Yosef Mayer, D. E. (2013) Marine resources in the Early Neolithic of the Levant: their relevance to early seafaring. In A. J. Ammerman and T. Davis (eds) *Island Archaeology and the Origins of Seafaring in the Eastern Mediterranean. Proceedings of the Wenner-Gren workshop Held at Reggio Calabria, October 19–21, 2012, in memory of John D. Evans*. *Eurasian Prehistory* 10, 83–98.
- Barton, A. (1991) Fishing for ivory worms: a review of *Dentalium* procurement methods. *The Midden* 23, 6–9.
- Biggs, H. E. J. (1963) On the mollusca collected during the excavations at Jericho, 1952–1958, and their archaeological significance. *Man* 153, 125–128.
- Biggs, H. E. J. (1969) Molluscs from human habitation sites, and the problem of ethnological interpretation. In D. Brothwell and E. Higgs (eds) *Science in Archaeology: a Survey of Progress and Research*, 423–427. London.
- Bocqueten, J.-P. (1998) Les ateliers de perles en coquillages marins des Pyrénées méditerranéenne. L'exemple de l'atelier de perles du 'Moulin' à Durban-Corbières (Aude). In G. Camps (ed.) *L'homme préhistorique et la mer. Actes du 120ème congrès national des sociétés historiques et scientifiques, Aix-en-Provence, 23–26 octobre 1995*, 259–272. Paris.
- Bonnardin, S. (2009) *La parure funéraire au Néolithique ancien dans les Bassins parisiens et rhénans*. Rubané, Hinkelstein et Villeneuve-Saint-Germain. Société Préhistorique Française (Mémoire XLIX). Paris.
- Bonnardin, S. (2012) Parures de coquillages du néolithique en Europe (VIe–Ve millénaires av. J.-C.), *Techniques & Culture* 59, 26–43.
- Calvet, J.-L. (2016) *La Méditerranée. Mer de nos langues*. Paris.
- Campana, S. E. (2001) Accuracy, precision and quality control in age determination, including a review of the use and abuse of age validation methods. *Journal of Fish Biology* 59, 197–242.
- Cannon, D. Y. (1987) *Marine Fish Osteology. A Manual for Archaeologists* (Department of Archaeology, Publication 18). Burnaby.
- Carlier, C. and Conte, E. (2009) Proposition de nouvelles approches dans l'étude des hameçons océaniques. *Le Journal de la Société des Océanistes* 128, 133–145.
- Carlson, C. (1988) An evaluation of fish growth annuli for the determination of seasonality in archaeological sites. In R. E. Webb (ed.) *Recent Developments in Environmental Analysis in Old and New World Archaeology*, 67–78. (British Archaeological Report S416). Oxford.
- Cassoli, P. F. and Tagliacozzo, A. (1995) Lo sfruttamento delle risorse marine tra il Mesolitico e il Neolitico alla Grotta dell'Uzzo, Trapani, (Sicilia) In *Atti del 1o Convegno Nazionale di Archeozoologia: Rovigo-Accademia dei Concordi, 5–7 marzo 1993*, 157–170. (Padusa Quaderni 1). Rovigo.
- Claassen, C. (1988) Techniques and controls for the determination of seasonality in shellfishing activities. In R. E. Webb (ed.) *Recent Developments in Environmental Analysis in Old and New World Archaeology*, 51–66. (British Archaeological Report S416). Oxford.
- Claassen, C. (1998) *Shells*. (Cambridge Manuals in Archaeology). Cambridge.

- Clason, A. T. and Prummel, W. (1977) Collecting, sieving and archaeozoological research. *Journal of Archaeological Science* 4, 171–175.
- Collette, B. B. and Nauen, C. E. (1983) *Scombrids of the World. An Annotated and Illustrated Catalogue of Tunas, Mackerels, Bonitos and Related Species Known to Date*. (FAO Fisheries Synopsis 125, Species Catalogue 2). Rome.
- Colley, S. M. (1984) Some methodological problems in the interpretation of fish remains from archaeological sites in Orkney. In N. Desse-Berset (ed.) *2èmes rencontres d'archéo-ichthyologie, Table ronde, Sophia Antipolis, Valbonne 14–16 octobre 1983*, 117–131. (Notes et Monographies Techniques 16). Paris.
- Colonese, A. C., Mannino, M. A., Bar-Yosef Mayer, D., Fa, D. A., Finlayson, J. C., Lubell, D. and Stiner, M. C. (2011) Marine mollusc exploitation in Mediterranean prehistory: an overview. *Quaternary International* 239, 86–103.
- Compagnoni, B. (1991) La malacofauna del sito mesoneolitico della Grotta dell'Uzzo (Trapani). *Rivista di Scienze Preistoriche* 43, 49–72.
- Cristiani, E., Farbstein, R. and Miracle, P. (2014) Ornamental traditions in the Eastern Adriatic: the Upper Palaeolithic and Mesolithic personal adornments from Vela Spila (Croatia). *Journal of Anthropological Archaeology* 36, 21–31.
- D'Angelo, G. and Gargiullo, S. (1978) *Guida alle conchiglie Mediterranee*. Milan.
- Dalby, A. (1996) *Siren Feasts: a History of Food and Gastronomy in Greece*. London and New York.
- Damalas, D. and Megalofonou, P. (2012) Discovering where bluefin tuna, *Thunnus thynnus*, might go: using environmental and fishery data to map potential tuna habitat in the eastern Mediterranean Sea. *Scientia Marina* 76, 691–704.
- Davidson, A. (2002) *Mediterranean Seafood*. London (3rd edition).
- Davidson, J. M. (1967) An archaeological assemblage of simple fish-hooks from Nukuoro atoll. *The Journal of the Polynesian Society* 76, 177–196.
- De Metrio, G., Arnold, G. P., de la Serna, J. M., Block, B. A., Megalofonou, P., Lutcavage, M., Oray, I. and Deflorio, M. (2005) Movements of bluefin tuna (*Thunnus thynnus* L.) tagged in the Mediterranean Sea with pop-up satellite tags. *Collective Volume of Scientific Papers ICCAT* 58, 1337–1340.
- Delamotte, M. and Vardala-Theodorou, E. (1994) *Κοχύλια από τις ελληνικές θάλασσες*. Athens.
- Desse, J. (1984) L'ichthyofaune du site néolithique de Khirokitia (Chypre). In A. Le Brun (ed.) *Fouilles récentes à Khirokitia (Chypre) 1977–1981*, I, 167–168. Paris.
- Desse, J., (1987) La pêche: son rôle dans l'économie des premières sociétés néolithiques en Méditerranée occidentale. In *Premières communautés paysannes en Méditerranée occidentale, Colloque international du CNRS, Montpellier 1983*, 281–285. Paris.
- Desse, J. and Desse-Berset, N. (1989). Les poissons de Khirokitia (campagnes 1983, 1984 et 1986). In A. Le Brun (ed.) *Fouilles récentes à Khirokitia (Chypre) 1983–1986*, 223–233. Paris.
- Desse, J. and Desse-Berset, N. (1992) Âge et saison de mort des poissons: application à l'archéologie. In J.-L. Baglinière et al. (eds) *Tissus durs et âge individuel des vertébrés, Colloque National Bondy, 4–6 mars 1991*, 341–353. Paris.
- Desse, J. and Desse-Berset, N. (1994) Stratégies de pêche au 8e millénaire: les poissons de Cap Andreas-Kastros. In A. Le Brun (ed.) *Fouilles récentes à Khirokitia (Chypre) 1988–1991*, 335–360. Paris.
- Desse, J. and Desse-Berset, N. (1996a) Archaeozoology of groupers (Epinephelidae). Identification, osteometry and keys to interpretation. *Archaeofauna* 5, 121–127.
- Desse, J. and Desse-Berset, N. (1996b) On the boundaries of osteometry applied to fish. *Archaeofauna* 5, 171–179.
- Desse, J. and Desse-Berset, N. (1996c) Ostéométrie et archéologie de la daurade royale (*Sparus aurata* Linné 1758). (Fiches d'ostéologie animale pour l'archéologie. Série A: Poissons 9). Juan-les-Pins.
- Desse, J. and Desse-Berset, N. (1999) Préhistoire du mérrou. *Marine Life* 9, 19–30.
- Desse, J. and Desse-Berset, N. (2011) Les poissons. In J. Guilaine, F. Briois and J.-D. Vigne (eds) *Shillourokambos: Un établissement néolithique pré-céramique à Chypre. Les fouilles du secteur 1*, 835–846. Athens, Paris.
- Desse-Berset, N. (1995) La pêche est au bout du jardin. Deux îles, hier et aujourd'hui. *Anthropozoologica* 21 (numéro spécial *L'homme et l'animal : Société de recherche interdisciplinaire HASRI. Colloque international N°5, Genève, Suisse, 23/11/1994*), 7–20.
- Eschmeyer, W. N. and Fong, J. D. (eds) (2016) *Species by Family/Subfamily*. <http://researcharchive.calacademy.org/research/ichthyology/catalog/SpeciesByFamily.asp>.
- Eschmeyer, W. N., Fricke, R. and Van der Laan, R. (eds) (2016) *Catalog of Fishes: Genera, Species, References*. <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>.
- Faget, D. and Sacchi, J. (2014) Fishing in the Mediterranean, past and present: history and technical changes. In A. Monaco and A. Prouzet (eds) *Development of Marine Resources*, 1–55. London and New York.
- Fischer, P. (1949) Rôle des coquillages dans les premières civilisations humaines. *Journal de Conchyliologie* 89, 82–93.
- Fischer, W., Bauchot, M.-L. and Schneider, M. (eds.) (1987) *Fiches FAO d'identification des Espèces pour les besoins de la pêche-Méditerranée et Mer Noire-Zone de pêche 37, Révision 1*, Vol. I: *Végétaux et Invertébrés*, Vol. II: *Vertébrés*. Rome.
- Forbes, M. H. C. (1976) Gathering in the Argolid: a subsistence subsystem in a Greek agricultural community. *Annals of the New York Academy of Sciences* 268, 251–264.
- Froese, R. and Pauly, D. (eds) (2016) *FishBase*. <http://www.fishbase.org>.
- Galili, E., Lernau, O. and Zohar, I. (2004) Fishing and coastal adaptation at Atlit-Yam. A submerged PPNC fishing village off the Carmel coast, Israel. *Atiqot* 48, 1–34.
- Germain, L. (1924) Les animaux marins d'après les écrivains et les artistes de l'Antiquité. *Bulletin de la Société d'Océanographie de France* 15–17, 359–393.
- Goujon, M. and Majkowski, J. (2000) Biological characteristics of tuna. In *FAO Fisheries and Aquaculture Department* [<http://www.fao.org/fishery/topic/16082/en>]. Rome.
- Graves, M. W. and McElroy W. (2005) Hawaiian fishhook classification, identification, and analysis, Nu'alolo Kai (SITE 50-30-01-196). In M. T. Carson and M. W. Graves (eds) *Kaua'i in Na Mea Kahiko o Kaua'i: Archaeological studies in Kaua'i* (Society for Hawaiian Archaeology Special Publication No. 2), 188–211. Honolulu.

- Guest-Papamanoli, A. (1984) Une pêche au guet: le *italiani*, origine, évolution et distribution géographique. In N. Desse-Berset (ed.) *L'exploitation de la mer de l'Antiquité à nos jours. La mer, lieu de production, V^{èmes} Rencontres d'Archéologie et d'Histoire d'Antibes*, 185–204. Paris.
- Ifantidis, F. (2006) 'Enigmatic' notched *Spondylus* ornaments from the Neolithic: new evidence from the Aegean. *The Archaeo-Malacology Group Newsletter* 9. 112. http://triton.anu.edu.au/issue_9.htm.
- Ifantidis, F. and Nikolaidou, M (eds) (2011) *Spondylus in Prehistory: New Data and Approaches: Contributions to the Archaeology of Shell Technologies*. (British Archaeological Report S2216). Oxford.
- Jeunesse, C. (1997) *Pratiques funéraires au Néolithique ancien. Sépultures et nécropoles des sociétés danubiennes (5500–4900 av. J.-C.)*. Paris.
- John, J. (2011) Status of *Spondylus* artifacts within the LBK grave goods. In F. Ifantidis and M. Nikolaidou (eds) *Spondylus in Prehistory: New Data and Approaches: Contributions to the Archaeology of Shell Technologies*, 39–45. (British Archaeological Report S2216). Oxford.
- Joleaud, L. (1935) Rôle magique et monétaire des coquilles de dentales fossiles et actuelles dans les temps préhistoriques et modernes. *Revue scientifique* 74, 495–500.
- Jones, D. S. (1988) Sclerochronology and the size versus age problem. In M. L. McKinney (ed.) *Heterochrony in Evolution. A Multidisciplinary Approach*, 93–108. New York and London.
- Karakulak, F. S., Özgür, E., Gökoğlu, M. Emecan, I. T. and Başkaya, A. (2011) Age and growth of albacore (*Thunnus alalunga* Bonnatere, 1788) from the eastern Mediterranean. *Journal of Zoology* 35, 801–810.
- Karali, L. (1983) Μαλακολογικό υλικό του σπηλαιού Αλεπότρυπα Διρού Λακωνίας. In *Διεθνές Συμπόσιο για τα προβλήματα των διευθετημένων σπηλαίων*, 1-4/9/1983, 229–232. Athens.
- Karali, L. (1998) Μαλακολογικό υλικό του σπηλαιού Αλεπότρυπα Μάνης. In *Άνθρωπος και Σπηλαιοπεριβάλλον, Πρακτικά Α' Πανελλήνιου Σπηλαιολογικού Συνεδρίου*, 26-29/11/1992, 107–114. (Αρχαιολογικά Δημοσιεύματα 68). Athens.
- Karali, L. (1999) *Shells in Aegean Prehistory* (British Archaeological Report S761). Oxford.
- Karali, L. (2011) Malacological material. In A. Sampson (ed.) *The Cave of the Cyclops: Mesolithic and Neolithic Networks in the Northern Aegean, Greece. Vol. II: Bone Tool Industries, Dietary Resources and the Paleoenvironment, and Archeometrical Studies*, 267–288. (Prehistory Monograph 31). Philadelphia.
- Kruz-Urbe, K. 1988. The use and meaning of species diversity and richness in archaeological faunas. *Journal of Archaeological Science* 15, 179–196.
- Lepiskaar, J. (1981–1983) *Osteologia: Pisces*. Göteborg.
- Luchesi, M. (2006) *Coquillages et crustacés. Le guide de la pêche à pied*. Paris.
- Miller, M. A. (1997) *Jewels of Shell and Stone, Clay and Bone: the Production, Function and Distribution of Aegean Stone Age Ornaments*. Unpublished PhD dissertation, Boston University.
- Morales, A. and Rosenlund, K. (1979) *Fish Bone Measurements. An Attempt to Standardize the Measuring of Fish Bones from Archaeological Sites*. Copenhagen.
- Moss, M. L. (1993) Shellfish, gender and status on the Northwest coast: reconciling archaeological, ethnographic, and ethnohistorical records of the Tlingit. *American Anthropologist* 95, 631–652.
- Mylona, D. (2003) The exploitation of fish resources in the Mesolithic Sporades: fish remains from the cave of Cyclope, Youra. In N. Galanidou and C. Perlès (eds) *The Greek Mesolithic: Problems and Perspectives*, 181–188. (British School at Athens Studies 10). London.
- Mylona, D. (2010) Mesolithic fishers at Maroulas Kythnos. The fish bones. In A. Sampson, M. Kaczanowska and J. K. Kozłowski (eds) *The Prehistory of the Island of Kythnos (Cyclades, Greece) and the Mesolithic Settlement at Maroulas*, 151–162. Krakow.
- Mylona, D. (2011) Fish vertebrae. In A. Sampson (ed.) *The Cave of the Cyclops: Mesolithic and Neolithic Networks in the Northern Aegean, Greece. Vol. II: Bone Tool Industries, Dietary Resources and the Paleoenvironment, and Archeometrical Studies*, 237–268. (Prehistory Monograph 31). Philadelphia.
- Mylona, D. (2014) Aquatic animal resources in Prehistoric Aegean, Greece. *Journal of Biological Research-Thessaloniki* 21, 2 (open access <https://doi.org/10.1186/2241-5793-21-2>).
- Nieszery, N. and Brienl, L. (1993) Zur Trageweise des Spondylusschmucks in der Linearbandkeramik. *Archäologisches Korrespondenzblatt* 23, 427–438.
- Oray, I. K. and Karakulak, F. S. (2004) Short description of the Turkish bluefin tuna (*Thunnus thynnus*) fishery in 2003. *Collected Volume of Scientific Papers ICCAT* 56, 1153–1157.
- Ottino, P. (1992) Anapua: Abri sous roche de pêcheurs; étude des hameçons (1ère partie). *Journal de la Société des océanistes* 94, 57–79.
- Papathanasiou, A. (2001) *A Bioarchaeological Analysis of Neolithic Alepotrypa Cave, Greece*. (British Archaeological Reports S961). Oxford.
- Papathanasiou, A., Larsen, C. S. and Norr, L. (2001) Bioarchaeological inferences from a Neolithic ossuary from Alepotrypa Cave, Diros, Greece. *International Journal of Osteoarchaeology* 10, 210–228.
- Papathanassopoulos, G. A. (2011) *Το Νεολιθικό Διρό. Σπήλαιο Αλεπότρυπα*. Athens.
- Pavúk, J. (1972) Neolithisches Gräberfeld in Nitra. *Slovesnka Archeologija* 20, 5–105.
- Peristeraki, P., Tserpes, G., Koutsikopoulos, C., Katselis, G. and Kallianotis, A. (2003) Length and weight conversion equations for bluefin tuna from the eastern Mediterranean Sea. *Collected Volume of Scientific Papers ICCAT* 55, 91–93.
- Perlès, C. (2016) Food and ornaments: diachronic changes in the exploitation of littoral resources at Franchthi Cave (Argolid, Greece) during the Upper Palaeolithic and the Mesolithic (39,000–7,000 cal BC). *Quaternary International* 407, 45–58.
- Pétréquin, P. (1984) *Gens de l'eau, gens de la terre. Ethno-archéologie des communautés lacustres*. Paris.
- Pope, G. T. and Goto, Y. (1991) *European Seashells*, Vol. I. *Poluplacochora, Caudofoveata, Solenogastra, Gastropoda*. Wiesbaden.
- Powell, J. (1996) *Fishing in the Prehistoric Aegean*. (Studies in Mediterranean Archaeology and Literature, Pocket-book 137). Jonsered.
- Powell, J. (2003) The fish bone assemblage from the cave of Cyclope, Youra: evidence for continuity and change. In

- N. Galanidou and C. Perlès (eds) *The Greek Mesolithic: Problems and Perspectives*, 173–181. (British School at Athens Studies 10). London.
- Powell, J. (2011) Non-vertebral fish bones. In A. Sampson (ed.) *The Cave of the Cyclops: Mesolithic and Neolithic Networks in the Northern Aegean, Greece*. Vol. II: *Bone Tool Industries, Dietary Resources and the Paleoenvironment, and Archeometrical Studies*, 151–236. (Prehistory Monograph 31). Philadelphia.
- Reese, D. S. (1983) The use of cone shells in Neolithic and Bronze Age Greece. *Annual of the British School at Athens* 78, 353–357.
- Reese, D. S. (1984) Topshell rings in the Aegean Bronze Age, *Annual of the British School at Athens* 79, 237–238.
- Reitz, E. J. and Shackley, M. (2012) *Environmental Archaeology*. (Manuals in Archaeological Method, Theory and Technique). New York.
- Reitz, E. J. and Wing, E. S. (1999). *Zooarchaeology*. (Cambridge Manuals in Archaeology). Cambridge.
- Rojo, A. L. (1991) *Dictionary of Evolutionary Fish Osteology*. Boca Raton.
- Rose, M. (1994) *With Line and Glittering Bronze Hook: Fishing in the Aegean Bronze Age*. Unpublished PhD dissertation, Indiana University.
- Ruiz, M., Rodríguez-Marín, E. and Landa, J. (2005) Protocol for sampling of hard parts for bluefin tuna (*Thunnus thynnus*) growth studies. In *Report of the Bluefin Tuna Direct Ageing Network (under the BYP Framework), Collected Volume of Scientific Papers ICCAT* 58, 1403–1419.
- Ruscillo, D. (2002) Reconstructing Murex royal purple and biblical blue in the Aegean. In D. E. Bar-Yosef Mayer (ed.) *Archaeomalacology. Molluscs in Former Environments of Human Behaviour, Proceedings of the 9th ICAZ Conference, Durham 2002*, 99–106. Oxford.
- Séfériadès, M. (2000) *Spondylus gaederopus*: Some observations on the earliest European long distance exchange system. In S. Hiller and V. Nikolov (eds) *Karanovo Band III. Beiträge zum Neolithikum in Südosteuropa*, 423–437. Vienna.
- Shackleton, J. C., Shackleton, N. J. and Deith, M. R. (1988) *Marine Molluscan Remains from Franchthi Cave*, (Excavations at Franchthi Cave, Greece, fascicle 4). Bloomington and Indianapolis.
- Sinoto, Y. H. (1991) A revised system for the classification and coding of Hawaiian fishhooks. *Bishop Museum Occasional Papers* 3, 85–105.
- Spiezia, M. C., Chiarabelli, C., Schininà, M. E. and Polticelli, F. (2014) Bioactive peptides from the venom of the Mediterranean cone snail *Conus ventricosus*. In T. B. Hughes (ed.) *Mediterranean Sea: Ecosystems, Economic Importance and Environmental Threats*, 135–148. New York.
- Sternberg, M. (2015) Pièges à poissons et pêcheries fixes de la Protohistoire à l'Antiquité en Méditerranée: les textes et l'archéologie. In D. Faget and M. Sternberg (eds) *Pêches méditerranéennes: Origines et mutations Protohistoire-XXIe siècle*, 37–68. Paris.
- Taborin, Y. (2004) *Langage sans parole. La parure aux temps préhistoriques*. Paris.
- Taschini, M. (1964) Il livello mesolitico del Riparo Blanc al Monte Circeo. *Bulletino di Paleontologia Italiana* 73, 65–88.
- Tercerie, S., Bearez, P., Pruvost P., Bailly, P., and Vignes-Lebbe, R. (eds) (2015) *Osteobase*. <http://www.osteobase.mnhn.fr>.
- Theodoropoulou, T. (2007a) La mer dans l'assiette: l'exploitation alimentaire des faunes aquatiques en Egée pré- et proto-historique. In C. Mee and J. Renard (eds) *Cooking up the Past: Food and Culinary Practices in the Neolithic and Bronze Age Aegean*, 72–88. Oxford.
- Theodoropoulou, T. (2007b) *L'exploitation des ressources aquatiques en Egée septentrionale aux périodes pré- et protohistoriques*. Unpublished PhD thesis, Université de Paris 1 Panthéon-Sorbonne.
- Theodoropoulou, T. (2008) Ο άνθρωπος και η λίμνη: ψαράδες και ψαρέματα στο προϊστορικό Δισπηλιό. *Ανάσκαμμα* 2, 25–45.
- Theodoropoulou, T. (2014) Excavating the sea: recent advances in marine zooarchaeology of prehistoric Aegean. In G. Touchais, R. Laffineur and F. Rougemont (eds) *PHYSIS. L'environnement naturel et la relation homme-milieu dans le monde égéen protohistorique, Actes de la 14^e Rencontre égéenne internationale, Paris 11–14 décembre 2012*, 359–373. (Aegaeum 37). Leuven.
- Tomkins, P. (2009) Domesticity by default: ritual, ritualization and cave-use in the Neolithic Aegean. *Oxford Journal of Archaeology* 28, 125–153.
- Trantalidou, K., Belegirinou, E. and Andreassen, N. (2011) Pastoral societies in the Southern Balkan Peninsula: the evidence from caves occupied during the Neolithic and the Chalcolithic Era. *Anodos* 10 (Special issue *Phenomena of Cultural Borders and Border Cultures across the Passage of the Time. Proceedings of an International Conference, 22–24 October 2010*), 295–320.
- Tripković, B., Dimitrijević, V. and Rajković, D. (2016) Marine shell hoard from the Late Neolithic site of Čepin-Ovčara (Slavonia, Croatia), *Documenta Praehistorica* XLIII, 343–362.
- Tudela, S., Sainz-Trápaga, S., Cermeño, P., Hidas, E., Graupera, E., and Quílez-Badia, G. (2011) Bluefin tuna migratory behavior in the western and central Mediterranean Sea revealed by electronic tags. *Collected Volume of Scientific Papers ICCAT* 66, 1157–1169.
- Turk, T. (1999) Poisonous and venomous organisms of the Northern Adriatic Sea. *Annales (Anali za istrske in mediteranske študije-Series Historia animalis)* 9) 2, 159–166.
- Van Neer, W., Zohar I. and Lerna, O. (2005) The emergence of fishing communities in the Eastern Mediterranean region: a survey of evidence from pre- and protohistoric periods. *Paléorient* 31, 131–157.
- VV. AA. (2011) *Archaeological Fish Resource*. <http://www.fishbone.nottingham.ac.uk>.
- Wilkens, B. (1993) Lo sfruttamento delle risorse marine. In F. Martini (ed.) *Grotta della Serratura a Marina di Camerota. Culture e ambienti dei complessi oloceni*, 89–98. Montelupo.
- Woodford, C. M. (1908) Notes on the manufacture of the Malaita shell bead money of the Solomon Group. *Man* 8, 81–84.
- WoRMS Editorial Board 2016. World Register of Marine Species. <http://www.marinespecies.org>.

Phytolith analysis from the sediments of Alepotrypa Cave

Georgia Tsartsidou

Introduction

Microremains serve as invaluable proxies for activities taking place at a particular spot: they both enter the substrate and are recovered close to where they were produced. Phytoliths are one such group of microremains that often have been used for reconstructing past human behaviour and use of spaces in archaeological sites. They are microscopic silica bodies (opal) that develop in the cellular system of the living plants (Piperno 2006). They are liberated and deposited in archaeological sediments either through a plant's death and decay or by its burning. Both may happen thanks to human agency. In this way phytoliths provide taxonomic information about the plant material brought into a site. The worth of phytoliths is owed to three criteria: 1) they are inorganic and therefore they are resilient components in most soil environments; 2) they are produced in high quantities and therefore they accurately characterise their context of discovery; and, 3) they show taxonomic affinities (Albert 2000).

The phytolith record reflects not only the archaeobotanical record but also the archaeozoological record, because phytolith analysis serves also as a proxy for the identification of herbivore dung (Shahack-Gross 2011). It provides indirect evidence of dung: a) by the high content of organic material and b) by the high frequencies of wild grasses and/or dicot leaf phytoliths that can be related to animal diet. Apart from phytolith concentrations in non-arid environments, herbivore dung, and especially livestock dung, is readily identified by the presence of faecal spherulites. These are calcitic spheres formed in an animal's guts (Canti 1999) and commonly found in dung remains.

This chapter presents the phytolith analysis conducted on samples from Alepotrypa Cave in order to investigate the activities performed therein for a better understanding of the nature of the human occupation of the cave. This is

achieved through the identification of phytoliths that can be attributed to plant types and parts, from the various localities in the site. The study is accompanied with the identification of spherulites in order to detect the presence of livestock dung in the cave sediments. The analysis focuses on the remains recovered from two different chambers and seven locations. The two different spaces/chambers (interior and exterior) are compared in order to determine whether there are differences in phytolith assemblages across space and also through time.

Materials and methods

Fifty-nine samples (Table 18.1) were collected from the chambers of the cave. They belong to seven different stratigraphic sequences of two areas, the exterior and the interior. Those from the exterior were collected from Chamber B. They are: a) the B3 section; b) the B1 section; and, c) the Petrocheilou Section. The material from the interior came from: a) niche Θ14/Th14 (henceforth Θ14); b) the corridor trench Z24/Th24 (henceforth Z24) and a surface sample and the trench in the corridor of Z22; and, c) the lake-chamber trench LA1. Different layers within the stratigraphic sequences were selected, *i.e.*, white ashy layers that represent combustion features, organic rich layers underlying them, clay floors and constructions, as well as the black organic rich sediment identified only in the interior of the cave.

Approximately half of the samples (AL1-AL40 and AL55-AL59) were taken in 2012 from stratigraphic profiles that belong to older excavation campaigns. The rest (AL41-AL54) were collected during the last excavation period (2013). They are presented in Table 18.1 with unit numbers. The two groups of samples were correlated when possible.

Samples AL20-AL28 are from the profile of the Petrocheilou section in Chamber B and they represent a

Table 18.1. Quantitative results. The table shows the amounts of phytoliths per gram sediment as well as the organic and carbonate component

Samples	Locus	Description	Starting	After ashing	AIF	Organics	Carbonates	Phytoliths/ g sediment
AL 1	B3	organic black under hearth	1.0439	0.959	0.8209	8.13	13.23	379
AL 2	B3	ash	1.0915	1.0412	0.4492	4.61	54.24	424,849
AL 3	B3	clay	1.0862	1.0076	0.8988	7.24	10.02	83
AL 4	B3	organic black under hearth	1.0064	0.9055	0.734	10.03	17.04	359
AL 5	B3	clay	0.9877	0.9063	0.804	8.24	10.36	36
AL 6	B3	ash	1.0421	1.0095	0.4071	3.13	57.81	25,395
AL 7	Ø 14	organic black under hearth	1.0575	0.8222	0.5615	22.25	24.65	15,209
AL 8	Ø 14	black sediment	0.9280	0.6096	0.3072	34.31	32.59	662,845
AL 9	Ø 14	black sediment	1.0650	0.6609	0.3560	37.94	28.63	591,648
AL 10	Ø 14	black sediment	1.1034	0.6683	0.3484	39.43	28.99	1,207,310
AL 11	Ø 14	ash	0.9607	0.8978	0.3222	6.55	59.91	876,486
AL 12	Ø 14	clay	0.9740	0.8839	0.8308	9.25	5.45	65
AL 13	Ø 14	ash	1.0336	0.9832	0.2713	4.88	68.88	382,523
AL 14	Ø 15	dark black fill above all	0.8589	0.6493	0.4800	24.40	19.71	4,277
AL 15	Ø 14	ash	1.0677	1.0114	0.5517	5.27	43.06	213,320
AL 16	Z22 left side corridor	black sediment	0.8962	0.4935	0.3315	44.93	18.08	100,471
AL 17	Z22 left side corridor	ash on top of dung	1.0309	0.9775	0.2085	5.18	74.60	221,357
AL 18	Z22 left side corridor	black sediment	0.9607	0.5133	0.3468	46.57	17.33	15,154
AL 19	Z22 right side corridor	black sediment	0.9331	0.6323	0.435	32.24	21.14	8,146
AL 20	Petroheilou	ashy sed rich in charcoal	0.9919	0.8648	0.518	12.81	34.96	629,083
AL 21	Petroheilou	clay	0.9576	0.8832	0.6195	7.77	27.54	353,824
AL 22	Petroheilou	white ash	0.9739	0.9523	0.3453	2.22	62.33	8,860
AL 23	Petroheilou	clay	1.0041	0.9345	0.6996	6.93	23.39	220,701
AL 24	Petroheilou	white ash	0.9693	0.9185	0.2165	5.24	72.42	787,963
AL 25	Petroheilou	organic black under hearth	1.0467	0.9432	0.6630	9.89	26.77	12,071
AL 26	Petroheilou	white ash on top of clay structure	1.0995	1.0377	0.4295	5.62	55.32	461,037
AL 27	Petroheilou	reddish black with clay (organic)	1.0059	0.8957	0.4797	10.96	41.36	15,193
AL 28	Petroheilou	white ash	0.9982	0.9702	0.0874	2.81	88.44	63,343
AL 29	B1 north	organic brown	0.9986	0.8455	0.526	15.33	31.99	2,547
AL 30	B1 north	ash	1.0431	0.8719	0.4489	16.41	40.55	136,270
AL 31	B1 north	brownish black	1.0968	0.9386	0.6418	14.42	27.06	1,599
AL 32	B1 north	brownish black	1.0362	0.9139	0.7039	11.80	20.27	1,040
AL 33	B1 north	brownish black	0.9679	0.8434	0.6501	12.86	19.97	392
AL 34	B1 north	ash	0.9843	0.9179	0.4722	6.75	45.28	16,054
AL 35	B1 north	ash	1.0111	0.9229	0.5301	8.72	38.85	56,554
AL 36	B1 west	ash	1.0618	0.948	0.4819	10.72	43.90	861,954
AL 37	B1 west	white ash	0.9159	0.8666	0.3299	5.38	58.60	348,697
AL 38	B1 west	white ash	1.0137	0.8832	0.4648	12.87	41.27	204,391
AL 39	B1 west	brownish sediment	1.0576	0.8861	0.5834	16.22	28.62	72,729
AL 40	B1 west	brownish sediment	0.9664	0.8655	0.5478	10.44	32.87	176,7055
AL 41	B1-K/839	ash	1.0647	0.9565	0.4858	10.16	44.21	148,254
AL 42	B1-I/812	white ash	1.0585	0.9873	0.4645	6.73	49.39	292,651
AL 43	B1-L/877	burial skull	1.5359	1.381	1.3264	10.09	3.55	440
AL 44	B1-H/880	burial charcoal	1.3341	0.9342	0.8096	29.98	9.34	277
AL 45	B1-H/880	burial under	1.1955	1.0809	0.9793	9.59	8.50	10
AL 46	B1-H/880	burial under	1.1260	1.0218	0.9290	9.25	8.24	264
AL 47	Ø14-B/854	clay floor	0.9474	0.7821	0.6563	17.45	13.28	20,871
AL 48	Ø14-B/856	white ash	1.0677	0.9277	0.4990	13.11	40.15	111,550
AL 49	Ø14-B/857	clay floor	1.0849	0.922	0.8216	15.02	9.25	17,874
AL 50	Ø14-B/866	white ash	0.9413	0.8691	0.5000	7.67	39.21	138,192
AL 51	Ø14-B/872	black sediment	1.0417	0.6664	0.3588	36.03	29.53	240,880
AL 52	Z24/884	black sediment	1.0175	0.5298	0.3234	47.93	20.29	21,649
AL 53	Z24/885	black sediment with clay frags	1.0098	0.6492	0.5490	35.71	9.92	64,617
AL 54	Z24/887	black sediment	0.9631	0.5092	0.2311	47.13	28.88	49,023
AL 55	LA1	black sediment	1.0084	0.5207	0.3489	48.36	17.04	256,627
AL 56	LA1	black sediment	1.1312	0.6103	0.3343	46.05	24.40	64,176
AL 57	Z22	black sediment	0.9904	0.777	0.5948	21.55	18.40	1,653,514
AL 58	Z22	black sediment	1.0738	0.851	0.6915	20.75	14.85	279,7874
AL 59	Z22	black sediment	0.9592	0.5184	0.3433	45.95	18.25	388,324

sequence of *in situ* hearths and clay platforms/floors. A date of c. 4,000 cal BC was retrieved (see chapters by Papathanassiou and Karkanas, this volume and Table 2.1).

The samples collected from the lowest 50 cm of the B1 section belong to hearths that consist of white and grey ashy sediments (AL41, AL42): these were positioned on basal paving stones after a shallow pit had been dug in the clay floor-surface. Human skeletal remains were revealed at the end of the excavation. Samples were collected from the head area (AL43), as well as from the charcoal-rich hearth (AL44) and the clay-rich sediment under the skeleton (AL45, AL46). A burial gave an age of c. 6,000 BC (see chapters by Papathanassiou and Karkanas, this volume).

The excavation in the interior of the cave was conducted at niche Θ 14 in Chamber C and at Z24. A date at the base of this sequence (in the black sediment) corresponds to c. 6,000 cal BC and a human bone from the top was dated to c. 3,900 cal BC. Θ 14 is a small cavity, a niche that preserves a sequence of *in situ* hearths constructed on top of clay floors. The whole sequence lies laterally above human skeletal remains. The stratigraphy of the Θ 14 trench is as follows: a succession of hearths (AL48, AL50) built upon broken clay sherds in turn spread on clay floors or constructions (AL7, AL11, AL13, AL15, AL47, AL49) and on the black sediment (AL8-10 and AL51) immediately over the rocky natural of the cave. An age of c. 4,200 cal BC was obtained from this hearth sequence.

The Z24 trench preserved an eroded hearth set on a base of broken sherds, similar to the ashy remains found at Z22 (AL17). The upper part of the deposit had been removed, probably in making of the corridor. This fire-related feature was created on a black sediment (AL52) that overlies another black sediment mixed with the remains of a clay floor-construction (AL53) which in turn overlies a very wet black sediment (AL54) on top of the rocky base of the cave. AL16, AL18, AL19 also are associated with the black sediment preserved at either side of the corridor: they are probably of the same deposition horizon as AL51 and AL54. Finally, the identical black sediment was sampled from Z22 (AL57-59) under the corridor and from an old trench in the lake area (AL5556), LA1. The trench under the corridor seems to preserve its stratigraphy intact; it has not lost its upper sediment as had Z24 trench.

The samples were analyzed in the Wiener laboratory of the ASCSA. They were treated as follows: Almost 1 gram of air-dried sediment was used from each sample. The samples were heated in a furnace at 500°C for 4 hours. The ash was then dried and weighed to measure organic loss after ashing. The value is not strictly accurate since it also reflects the loss of water from the sediments, but it gives a rough estimate of the amount of organic loss. The ash was then transferred in glass vials and treated with 1N HCl that was put in boiling water to remove

calcite. The samples were then dried under a heat lamp and weighed again.

What is left constitutes the Acid Insoluble Fraction (AIF), *i.e.*, the fraction that contains no organics and no carbonates. The AIF was transferred into a centrifuge tube and 5 ml of non-toxic heavy liquid (Sodium polytungstate) were added. The suspension was sonicated for 30 minutes until it was well dispersed. It was then centrifuged at 3,500 rpm for 20 minutes. The supernatant was transferred to another centrifuge tube, 1 ml of water was added, and again the sample was centrifuged as above. This cycle was repeated again, then the tube was filled with water for the final centrifugation and wash. The denser minerals (quartz, clay) were thus separated from the less dense silica in 4 stages. The last two fractions that contained all the phytoliths were weighed when dry. About 1 mg of each of these fractions was more accurately weighed out and this was then placed on two slides. Entellan glue (Merck) was added and cover slips were lowered carefully over the well-mixed suspensions.

The slides were then analyzed under a petrographic microscope. The assemblages were studied both quantitatively and qualitatively. Phytoliths were counted and taxa were classified. Ideally 200 phytoliths were counted from each slide, when possible, since it has been demonstrated (Albert and Weiner 2001) that the counting of 194 phytoliths gives an error of $\pm 23\%$. The total number of phytoliths on the slide (consistent and variable morphology) was then determined and related to 1 gram of sediment). The samples in which fewer than 100 phytoliths were counted on a slide have not been included in the morphological analysis because of the large statistical error present.

As for the qualitative analysis, the phytolith assemblages were described following the International Code for Phytolith Nomenclature (Madella *et al.* 2005) when possible. They were separated into two major categories: those with consistent morphologies that repeat themselves in more than one sample and those with variable morphologies, with irregular and unidentifiable morphologies. Phytoliths with consistent morphologies were classified and their relative proportions were determined. Such phytoliths are classified into families, genera, and part of the plants. The main categories emerging from this analysis are the woody parts, fruits and leaves from dicotyledonous trees and bushes, as well as the grasses (the inflorescence and stem/leaf parts), sedges, and reeds. Regarding the grasses the analysis descends even to the sub-families, *i.e.*, Pooideae (C3 tall wild grasses, in which most of the cereals fall), Chloridoideae (C4 short wild grasses that are drought-adapted plants flourishing in prairies), Panicoideae (tall C3 and C4 wild grasses of warm and wet climates). When articulated phytoliths are preserved, their genus (*e.g.*, wheat, barley) is classified.

Finally the loose sediment of the samples was examined under the microscope before the chemical treatment (using

entellan glue and a cover slip) in order to detect the possible presence of faecal spherulites.

Results

Organic and carbonate component

Figure 18.1 shows the organic component of all the samples analyzed. The samples are presented in ascending order by their % content. The black sediment samples of the interior of the cave outnumber the rest; their organic component constitutes almost half of the sediment composition (32–48%) as opposed to the rest of the samples, and especially the ashy sediments. Most of the latter do not exceed 10%. This highly organic character, together with the presence of faecal spherulites in the black sediments, indicates the presence of dung. It is worth noticing that faecal spherulites have been recovered from most of the samples that come from the black sediment, albeit in low numbers, as opposed to the white ashy sediments that are devoid of spherulites. Their absence in some of the black sediment samples (*e.g.*, AL18 and AL19) as well as the low numbers in general may be explained taphonomically; a highly calcitic environment would be responsible for the dilution of faecal spherulites (Canti 1999). Macphail *et al.* (2004) noted that liquid animal waste in stables created anaerobic and acidic conditions that promoted phosphatic crust formation and the leaching of dung spherulites. This could indicate that the dung originates from a stable where it had accumulated for long time. The repetitive burning of the dung may also cause damage to the spherulites.

Such burning is also verified by the phytolith assemblages that are highly weathered, preserving an etched (bubbled) surface due to high temperature.

Apart from the deposits from the cave interior, the only sample that preserved spherulites is AL40, from the profile of the B1 section. This is of a different character than the black sediment of the interior; it is not black and it does not show signs of repetitive burning.

A comparison with modern dung samples (Figure 18.2) shows that the only dung samples (black columns) that preserve almost 50% organics are the ones of composted sheep dung (collected and stored for at least one year). The other samples preserved 70–90%, with the exception of one sample from fresh cow dung that preserved 64%. By contrast, composted goat dung preserves 85% organics.

Figure 18.3 presents the carbonate component of the samples. Carbonates in Alepotrypa Cave are represented by the calcite created by the burning of wood. Wood combustion produces an ash that, on average, is composed of 98% of fine-grained calcite and 2% of siliceous aggregates along with phytoliths (Schiegl *et al.* 1994, 1996). In the chart, the samples are in ascending order. As expected, the richest samples are in the ashy layers. The highest frequencies (up to 90%) are in the Petrocheilou Profile, which points to the use of wood alone as the main material used for fuel. The lowest frequencies (below 10%) are in the clay samples of the North Section, implying that their use probably involved no ash, unlike the Petrocheilou Profile clay constructions with their higher carbonate frequencies (23% and 28%) preserved.

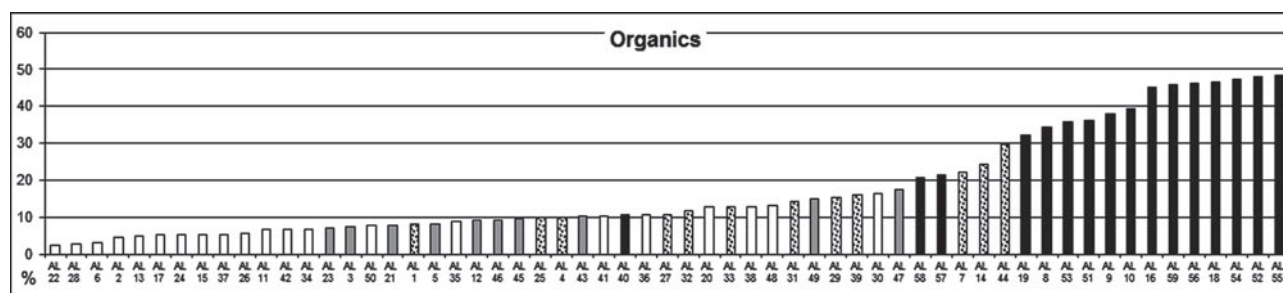


Figure 18.1. Organic component of the sediments. The layers are shown in ascending order. The black columns are for the black sediments (dung), the white are the ash, the grey are the clay constructions, and the spotted columns are the organic layers (colours apply to all subsequent figures in this chapter).

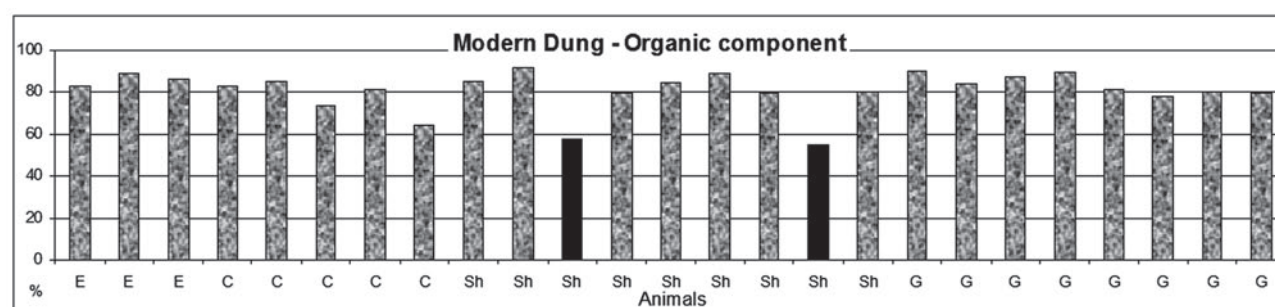


Figure 18.2. Frequencies of organic component in modern dung samples from GT reference collection (countries of provenience Greece, Turkey, Albania).

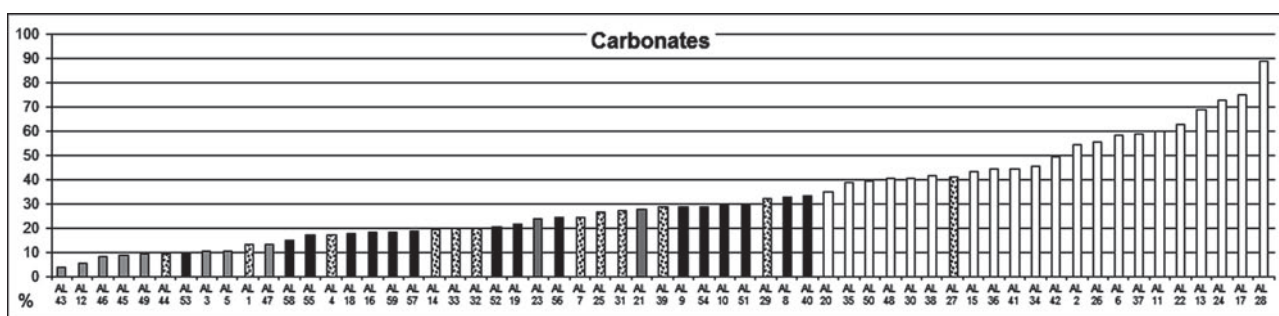


Figure 18.3. Carbonate component of the sediments. The layers are shown in ascending order.

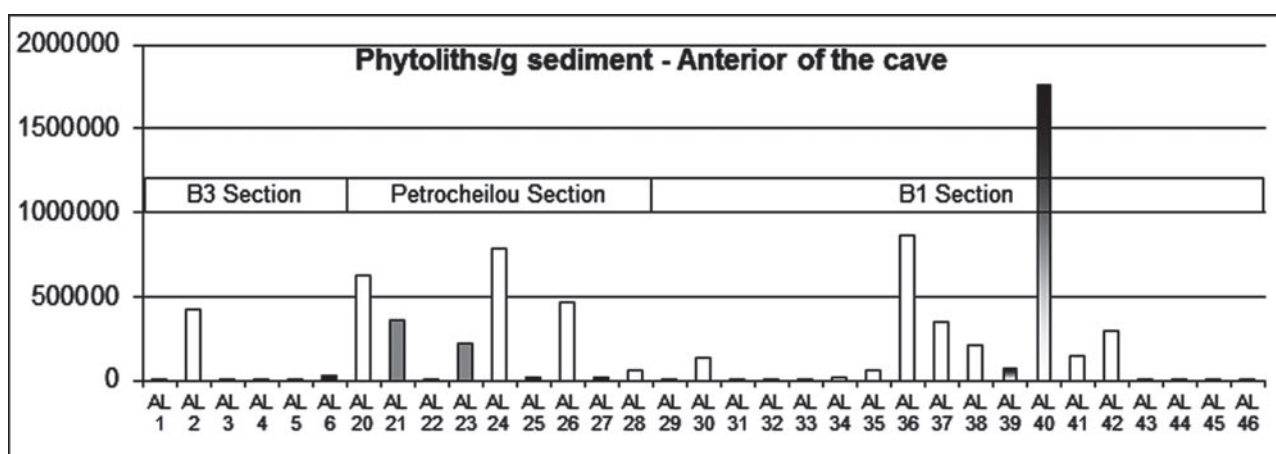


Figure 18.4. Amounts of phytoliths per gram sediment. Anterior of the cave.

Apart from the B3 section, the rest of the samples are rich in calcite (above 20%) reflecting the raking out, dumping, and trampling of ash. It is worth noticing the higher frequencies of carbonates (29–33%) in the Θ14 black sediment, indicating that ash was present.

Archaeological phytolith assemblages

The phytolith assemblages of the cave sediments vary in their quantities considerably (Table 18.1). The black sediment samples collected from Z22 under the corridor have the richest assemblages. The lowest amounts of phytoliths have been recovered from the B3 section and all the clay constructions, as well as the clay-rich sediment related to the lowest burial of the B1 section.

Anterior of the cave

Comparing the three loci of the anterior of the cave, *i.e.*, the B3, B1 and the Petrocheilou sections, we notice that quantitatively the phytolith assemblages vary considerably (Figure 18.4).

THE B3 SECTION

The B3 section is characterised by low numbers of phytoliths, with the exception of the two ashy layers – AL2 and AL6 – that produced approximately 400,000 and 12,000 phytoliths per gram of sediment respectively. The rest of the B3 section samples, *i.e.*, clay constructions and

sediments under the hearths, produced minor amounts of phytoliths (less than 400 phytoliths per gram of sediment). These have not been included in the morphological analysis. The ashy layers (AL2 and AL6) contain 54% and 58% carbonates (calcite) respectively indicating the presence of wood ash in the combustion features that they represent. Small amounts of wood phytoliths occur in these samples (Figure 18.5).

It is worth comparing the two ashy layers, AL6 and AL2, in order to examine the material used for fuel and/or the plants discarded in these hearths. As discussed above, AL2 is richer in phytoliths than AL6. The latter produced large amounts of non-identifiable melted phytoliths (42%), *i.e.*, phytoliths affected from a high temperature fire (Figure 18.6). It preserves also the highest frequencies of phytoliths produced by the leaves of dicotyledonous plants (20%), as well as 6% of reed phytoliths (Figures 18.7 and 8, respectively). Finally, ash pseudomorphs created after the heating of calcium oxalates that form in the leaves of the dicot plants have been detected. By contrast, AL2 produced only 2% of dicot plant phytoliths and less than 0.5% reed phytoliths. In addition, no ash pseudomorphs have been identified.

Grasses are the predominant taxa and the Pooideae subfamily prevails in both samples. AL6 has much lower frequencies of grasses (60%) and Pooideae (18%) than AL2, which produced 89% grasses, 68% of which are

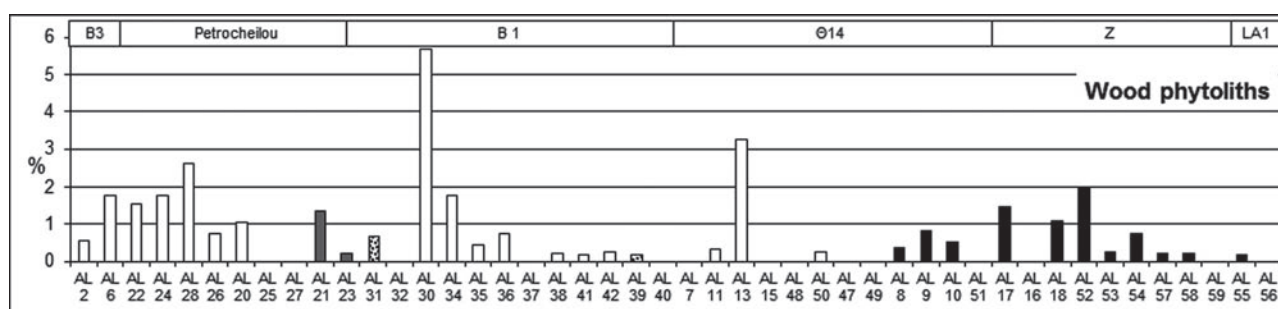


Figure 18.5. Frequencies of wood phytoliths.

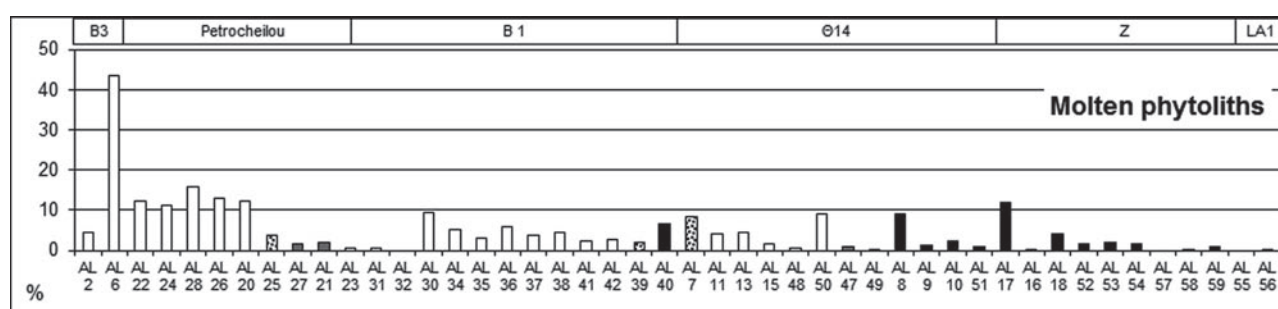


Figure 18.6. Frequencies of phytoliths that show signs of melting probably from strong fire.

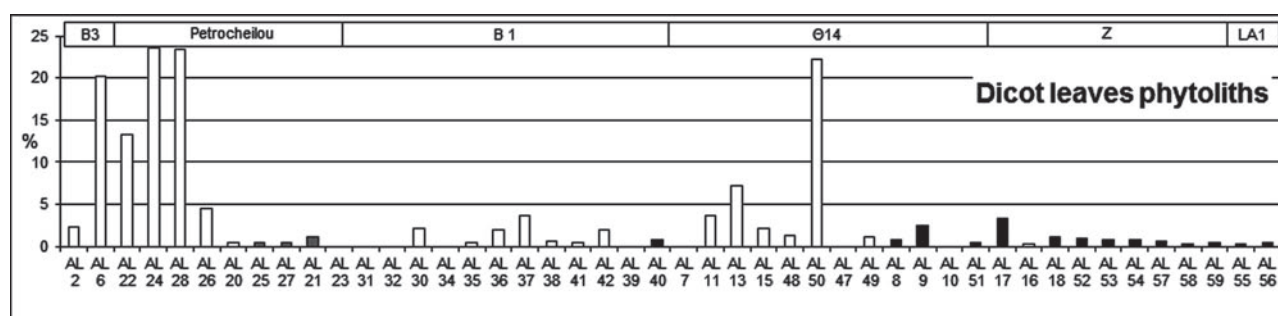


Figure 18.7. Frequencies of phytoliths assigned to the leaves of dicotyledonous plants (trees and shrubs).

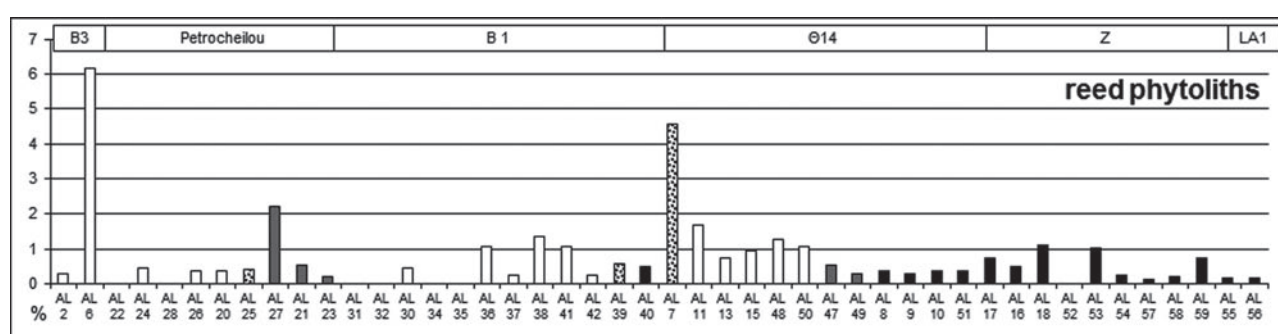


Figure 18.8. Frequencies of reed phytoliths.

Pooideae (Figure 18.9). The latter are characteristic grasses associated with the Mediterranean climate, and they are the most common ones found at archaeological sites in the region. Most of the cereals belong to the Pooideae group as well. No cereal phytoliths were identified in either ashy layer (Figure 18.10). Wild grasses are recovered in low

frequencies (up to 2%) from both samples (Figure 18.11). Regarding the part of grasses (Figure 18.12) identified we notice that AL6 preserves similar amounts of straw (stem/leaf phytoliths) and inflorescence (husk phytoliths), i.e., 14% and 19% respectively, as opposed to AL2 where husk phytoliths (17%) outnumber the straw ones (3%).

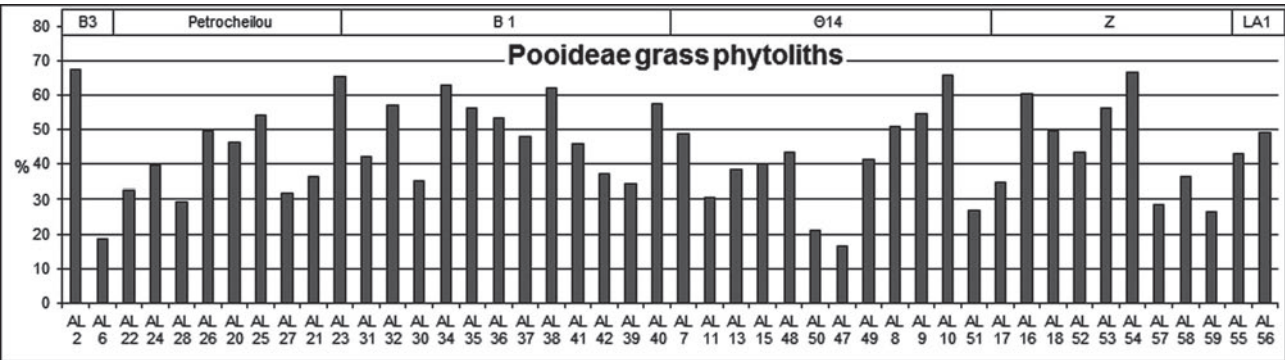


Figure 18.9. Frequencies of Pooideae grass phytoliths.

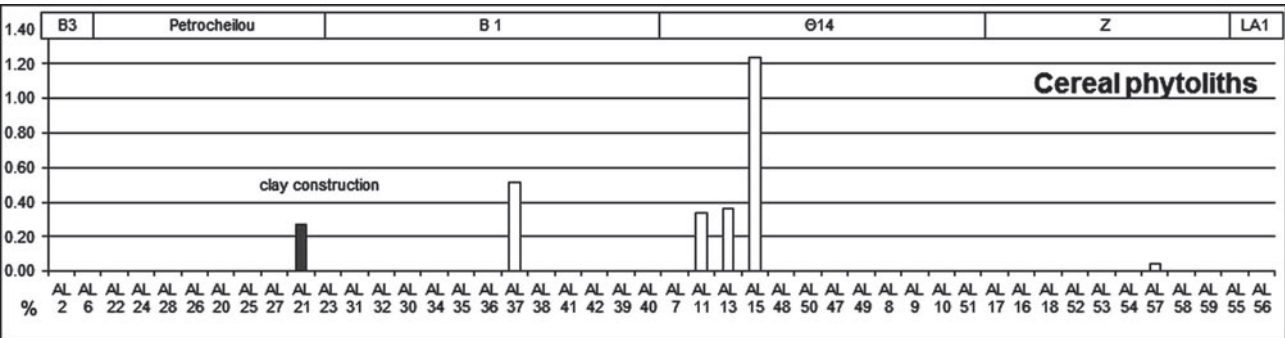


Figure 18.10. Frequencies of cereal phytoliths.

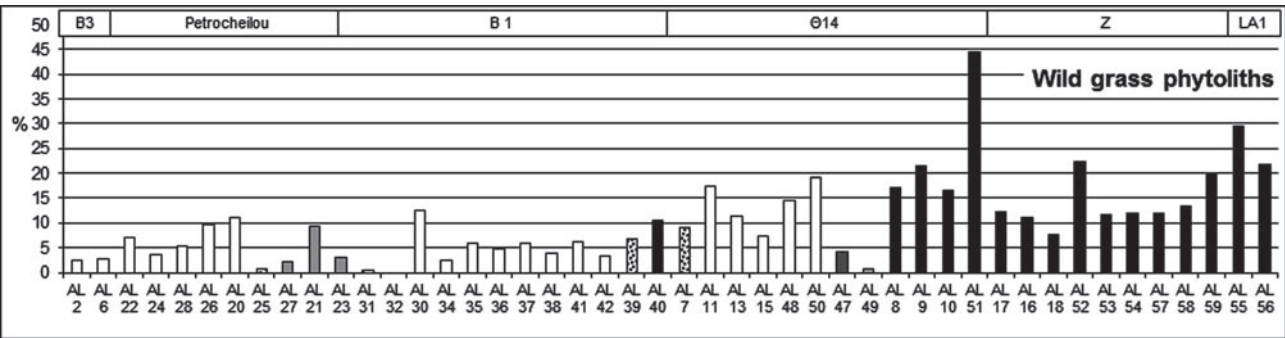


Figure 18.11. Frequencies of wild grass phytoliths.

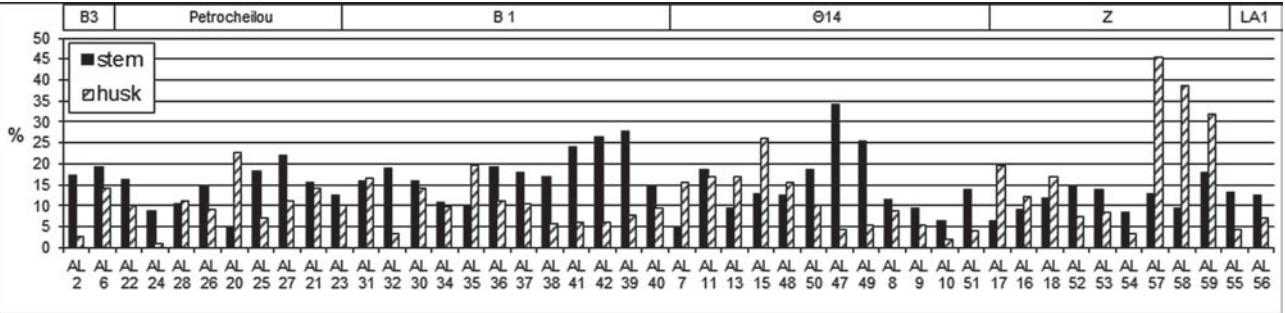


Figure 18.12. Frequencies of stem and husk grass phytoliths.

THE B1 SECTION

The brownish sediments (clay rich) contain very low phytolith concentrations (no more than 2,500) as opposed to the ashy sediments that preserve 140,000–900,000

phytoliths per gram of sediment (Figure 18.4). These are combustion features rich in carbonates (39–59%). The organic component varies (Figure 18.1). The highest frequency (16.4%), much lower than the black sediments

of the cave interior, is seen in sample AL30. Few spherulites have been identified, indicating that dung was but a small component in the fuel. Although the carbonate content points to wood ash, the amounts of wood phytoliths identified are very low (less than 2%) and AL30 is the only exception preserving almost 6%. All ashy layers contain dicot leaf phytoliths pointing to the use of leafy branches for fuel. A similar picture emerges from AL40: an unburnt dung-rich sediment loaded with faecal spherulites. Both AL30 and AL40 contain high frequencies of wild grasses and low frequencies of dicot leaves. This is similar to the frequencies recovered from the dung-rich sediments of the interior (see below).

In most layers of B1 stem/leaf phytoliths and husk phytoliths were recovered in similar frequencies. The exception is seen in AL28 where 25% of the grasses material belongs to stem/leaf phytoliths and only 6% to husk phytoliths. The opposite case applies to AL35 where 20% are grass husk phytoliths and 10% belong to stem/leaf. These differences seem to be random, indicative of no particular use since there is no clear pattern. Most probably they could relate to that part of the grass (with flowers or not) used to start the fire. AL28 produced also 4% of dicot fruits. Since no dicot leaves are present, these fruits were not still on the bough nor had whole fruiting bushes been used for fuel. Rather it is a case of fruits being discarded into the fire after consumption.

THE PETROCHEILOU SECTION

Several different layers have been sampled: clay constructions, ashy layers and organic-charcoal rich layers underlying the combustion features. Figure 18.4 shows that the higher amounts of phytoliths have been recovered from the ashy layers, *i.e.*, the combustion events (AL20, 24, 26). Such features in this section are characterised also by the highest frequencies of carbonates (up to 90%). Morphologically they preserve relatively high frequencies (3–4%) of wood phytoliths (Figure 18.5) and very high

frequencies (up to 24%) of dicot leaf phytoliths. It is worth noting that all the ashy layers contain ash pseudomorphs (calcium oxalates, druses, etc.), verifying the presence of leafy wood. Melted phytoliths (Figure 18.6) have been identified in all the ashy layers at 10%–15%, indicating high temperature fires. All the above indicate that wood was definitely the major component of the Petrocheilou section hearths. All the ashy layers have been examined for spherulites; none has been recorded. This implies that dung has not been used for fuel in this location.

Ash may have been involved also in the creation of the clay platforms since the carbonates are relatively high (23–28%) and both the clay layers AL21 and AL23 preserve some wood phytoliths. AL21 preserves a small amount of cereals; it also contains 15% husk phytoliths. The highest amount of husk phytoliths (23%) has been produced by sample AL20 (from an ashy layer rich in charcoal). On the other hand the amount of stem/leaf phytoliths in AL20 is very low (5%), which implies the presence of grass seeds but not the whole plant. These data point to wood as the major component of fuel, whilst seeds from grasses may have been discarded in the hearth, probably after use. Fruits of hackberry (*Celtis* sp.) and gromwell (*Lithospermum arvense*) have been recovered from two of the ashy layers of Petrocheilou section.

Interior part of the cave

The samples were collected from several areas of the inner part of the cave: niche Θ14, Z22 and Z24 as well as a lake-chamber trench (LA1).

The richest area of the interior is under the corridor at Z22 (Figure 18.13), where black sediment samples (AL57–59) preserve 0.3–3 million phytoliths per gram of sediment. Similarly the samples from the black sediment (AL8–10) of niche Θ14 preserve 0.7–1.2 million phytoliths per gram of sediment. The combustion features (ash) of niche Θ14 produced 140,000–900,000 phytoliths: poorer than the black sediment but much richer than the clay

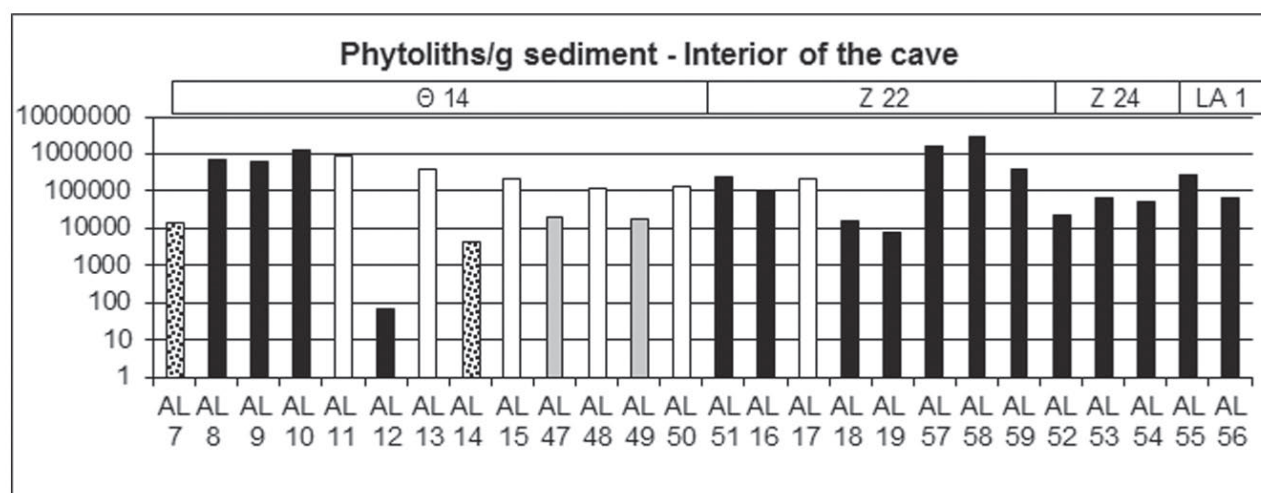


Figure 18.13. Amounts of phytoliths per gram sediment. Interior of the cave.

floors that preserve only up to 21,000 phytoliths per gram of sediment.

Morphologically there are strong differences in the phytolith assemblages between the black sediment and the combustion features. The black sediment produced less than 2% phytoliths from leaves of dicot plants (trees and shrubs) as opposed to the combustion features that preserved up to 22% (Figure 18.7). This shows that the dicot leaves were brought into the interior of the cave as plant material used for fuel and not with the dung. On the other hand the black sediment of niche $\Theta 14$ (as well as that seen in Z22 and Z24 and LA1) is much richer in wild grass phytoliths and more specifically in Panicoid and Chloridoide grasses than the ashy layers. The Chloridoide (Figure 18.14) have been recovered in high frequencies (up to 31%) from the black sediment as opposed to the ashy layers that preserve no more than 7%. In other parts of the cave the Chloridoide grasses do not exceed 6%.

Cereal husk phytoliths (both barley and wheat) have been identified in minor frequencies (up to 1.2%) and mainly in the ashy layers (AL11, AL13, AL15). They are almost absent from the black sediment.

The frequencies of husk (grass inflorescence) and stem/leaf (straw) phytoliths do not show a clear pattern that would justify an identification of special activities apart from the three samples collected from the black sediment under the corridor. The hearths preserve more husk phytoliths than stem/leaf ones but not in any very high manner. Their frequencies are compatible with those of husk vs. stem phytoliths that the modern grasses produce

(Tsartsidou *et al.* 2007). That means that the whole plant has been used in the combustion events, probably utilised to set the fire; there is no evidence of any special input of grass seeds that could be related to storage or seed processing. The ashy sample that shows a higher input of husk phytoliths (26%) vs stem/leaf phytoliths (13%) is AL15. This is the same layer with the highest frequency of cereal phytoliths (1.2%). This may suggest the discard of cereal seed husks in the fire after some small scale process or consumption. By contrast in the black sediment cereals are absent and in some samples the husk phytoliths, are preserved at higher frequencies than the stem/leaf phytoliths. This is especially strong in AL57-59 that produced 32-45% husk phytoliths. Since only wild grasses have been identified in the black sediment a free range diet of the animals is implied by these high frequencies of husk phytoliths.

The clay floors/platforms (AL47 and AL49) preserve 34% and 25% straw phytoliths respectively. This could suggest a possible use of grass straw during the construction of the clay floor/platforms.

Riverine plants have been identified. Sedges (Cyperaceae and Juncaceae) phytoliths are rarer (less than 1%) (Figure 18.15) than the reed phytoliths recovered in almost all the samples from the inner part of the cave. The highest frequency of reed phytoliths (5%) has been recovered from the organic rich layer of a combustion feature in $\Theta 14$ (AL7). This may indicate the use of reeds for construction, such as for making fences, mats, or baskets.

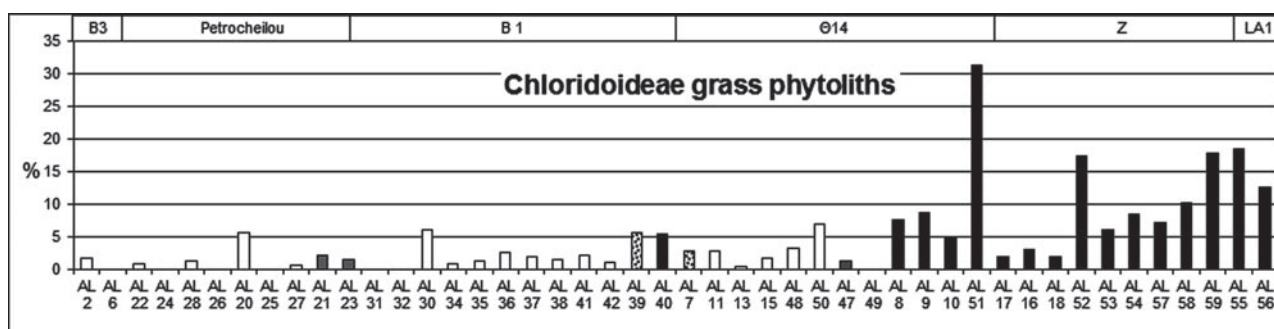


Figure 18.14. Frequencies of Chloridoideae grass phytoliths.

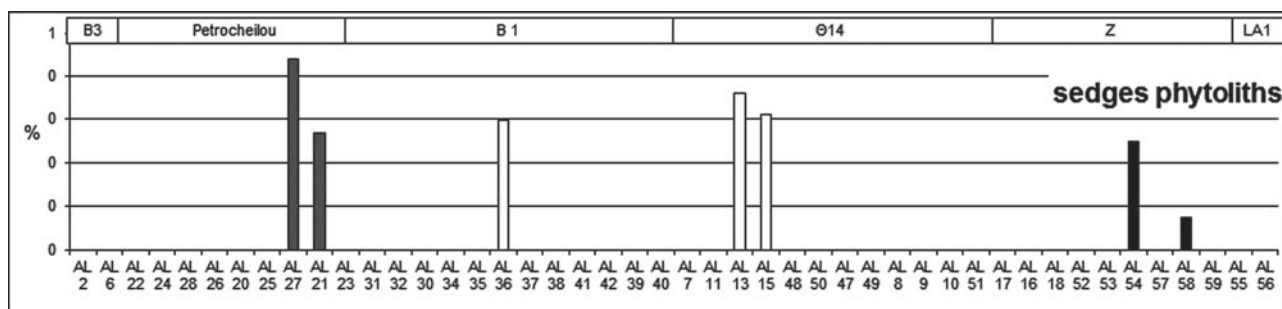


Figure 18.15. Frequencies of phytoliths assigned to sedges (Cyperaceae and Juncaceae).

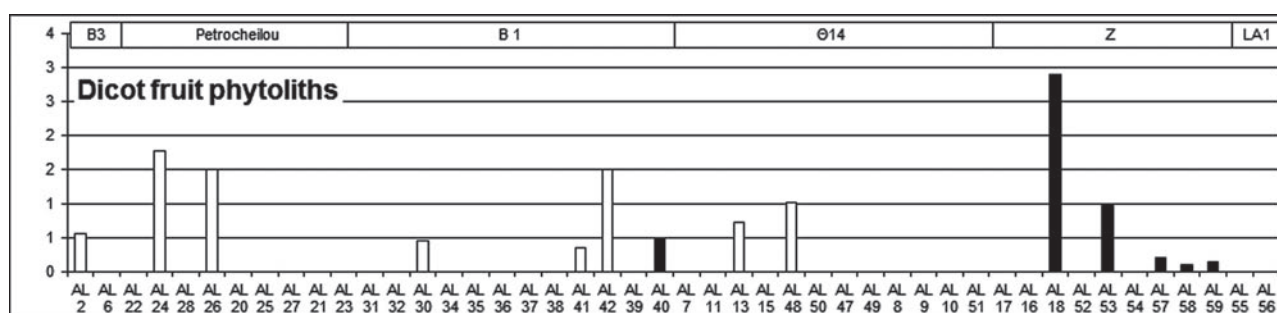


Figure 18.16. Frequencies of phytoliths assigned to fruits of dicotyledonous plants (*Celtis* sp. and *Lithospermum arvense*).

Fruits from dicotyledonous plants, mainly fruits of hackberry (*Celtis* sp.) and some gromwell (*Lithospermum arvense*) seeds, have been found in small amounts (up to 3%) in both the ashy layers and the black (dung) sediment (Figure 18.16). They may have been part of the animal diet and/or consumed and discarded in the hearth by humans.

Wood phytoliths show the highest frequency in the hearth of Θ14. They have also been recovered at a level of 2% in the black sediment of Z22 and 24, indicating the presence of wood in the dung-rich soil.

Discussion

Spatial arrangement and use of the cave

This analysis of the phytolith assemblages suggests different activities were carried out in the interior and anterior parts of the cave. The interior of the cave preserves large volumes of the black sediment that is rich in burnt dung. These kinds of deposits have not been identified in the anterior of the cave. According to the absolute but also relative chronology, the black sediments covering a large area in the lake chamber and the corridor span from late EN to FN.

Dung would have been produced by any animals kept in the cave or it could have been brought into the cave on purpose by humans. The use of caves as stables is not uncommon. However the chances that the inner part of this cave was used as a stable seems unfeasible since: 1) the traces of the old corridor that lead to the large lake chamber suggest that the opening was in antiquity very narrow, tight, and could only be accessed after descending several meters (Karkanas, this volume) – making the herding of animals into the interior area impossible; and, 2) no other exit-entrance to the interior of the cave existed. Animals cannot be forced to crawl or enter through a dark, low, and narrow opening. If the dung was not produced by stabled animals, it was definitely brought in by humans.

Since it was burnt, the most plausible reason for dung being brought inside is to be used for fuel. The use of dung for fuel is common; it has been ethnographically documented that it was in use in the houses of Greek Thessalian villages even in the 20th century (Gouriotis 1994). Dung is a cheap and easily acquired material

especially in pastoral societies. It is also much lighter than wood, which might have been a criterion for its choice here, since access to the lake chamber required a lot of effort. Composted dung is even lighter to carry. Dung produces temperatures similar to wood when burnt. It has been demonstrated experimentally that it produces heat as fast as wood does, but it keeps the fire steadier over time (Gur-Arie et al. 2013). The fire does not fluctuate the way a wood one does when fresh fuel is added. Such a fire is thus easier to control in such a closed environment. The fact that the sediment is rich in small pieces of charcoal shows that the process of combustion was incomplete; pure white ash without any charcoal would otherwise have been produced.

This black sediment is rich in broken pottery. The fragmentary character of these sherds together with the dung could be explained if the sediments had accumulated in a refuse-dumping area. Agricultural fields are known to receive a certain amount of artefacts together with manure (Forbes 2013). Composted dung is often dumped with domestic refuse in middens (Forbes 2013). Using the interior of Alepotrypa as a midden would however be impossible; the huge effort required would make the attempt quite impracticable. In addition, the deliberate interspersing of laid clay surfaces between deposits of the sediment (Karkanas, this volume) is not an action compatible with a dumping area. Finally, neither pottery nor lithics show evidence of any domestic use; they do not resemble used artefacts that are found in the anterior part of the cave (Psimogiannou and Kourtesi-Philippaki, both this volume).

The hearths in the interior of the cave were fed with several types of fuel. The small combustion features of pure white ash set on top of the black sediment were not fuelled with dung, but rather with leafy wood and grasses, indicating different types of fire. Maybe they were used for cooking. It is worth adding that the cereal husks were found only in these combustion features. Such diversity shows that the interior of the cave was used variably: a large volume of burnt dung in the corridor and the niches, small hearths used for cooking or small scale food processing with clay floors and platforms, and finally, niches probably defined or matted with reeds in

company with artefacts apparently unused. None of these show a domestic character but they do indicate evidence of careful maintenance. To achieve this, people had to crawl through Chamber Z in order to enter the lake chamber. Carrying items as well as fuel material and clay for the constructions would have required a lot of effort. All this expenditure of effort indicates that the interior of the cave was an area of special importance. Taking also into consideration a range of factors – namely the heavy smell and smoky atmosphere, the secondary burials (Papathanasiou, this volume), the fragmentation of the pottery that seems to have been deliberate (Psimogiannou, this volume) and the fine lithics that show no evidence of use (Kourtessi-Philippaki, this volume), a special use conceivably related to symbolic or ritual activities is inferred for this part of the cave.

Conversely, the anterior of the cave preserves evidence of very different patterns of use. Access was easy; dung was recovered only sporadically and not repetitively burnt in the upper layers of the B1 section. Here too were preserved successive burials and constructed hearths. The plant material identified from the phytolith analysis of these hearths does not provide evidence of some special use, apart from one layer that preserved minor amounts of cereals. The latter does not suggest any large scale processing of cereals. It could indicate the consumption of cereals or the disposal of cereal waste in the hearth after small-scale food handling. If these hearths were related to the dead buried merely centimetres below them, then the cereal residues themselves also could have been part of the same processes of ceremony or memorial.

The Petrocheilou section preserves clay platforms/floors and hearths fuelled with leafy wood branches in large quantities, creating strong fires of high temperature. The clay platform and a combustion feature preserve some remains of cereal husks showing that some small preparation might have taken place in that area. Scanty remains of dicot fruits also might point to some fruit consumption. Dung was not involved in any of the features analysed, although sporadic remains have been identified by micromorphology (Karkanis, this volume). This is an area that shows a more ‘domestic’ character than the rest areas of the cave but still on a minor scale (see discussion in Papathanasiou, Chapter 23, this volume).

The B3 section seems very different from the rest of the areas analysed. It is the only area where raking out, dumping, and trampling of ash has not been reflected in the phytolith assemblages. Dung was not involved either in the hearths or the rest of the sediments investigated. The two ashy layers analysed represent different episodes of hearth use. They preserve greatly different assemblages underlining this. The relatively higher frequencies of *Pooideae* grass phytoliths in one of the combustion features might indicate that summer grasses were discarded in this hearth after use or that they were used as kindling. This finding indirectly suggests that this hearth episode took

place during summer, when grasses are dry. By contrast, the later hearth episode preserves mostly leafy branches. If this is not simply the result of human choice (that could still be related to a different use and purpose of the hearth), then it could suggest a winter-time use, should the leaf phytoliths of this hearth come from non-deciduous trees. This aspect needs to be further investigated with the contribution of the anthracological data. If the aforementioned differences and interpretations of the two hearth episodes prove accurate, then a year round use of the cave is inferred.

The archaeological finds from this area (e.g., storage vases and pithoi) indicate that storage occurred here. The lack of cereal husk remains as well as the small amounts of husks recovered from the sediments analysed do not actively support the argument for any cereal storage. However if cereal seeds already dehusked and processed outside the cave were stored, then the poor phytolith record would be expected, since seeds without husks do not produce phytoliths. It has been ethnographically demonstrated (Hillman 1981, 138) that in wet-climate sites the grain glume of wheat is less likely to spoil if it is stored as spikelets rather than as naked grain. And if the cereal was stored as spikelets the phytolith record would have been rich. Nevertheless, sampling was not extensive and we lack samples directly from the interior surface of the large vessels that were excavated and cleaned during the early years of excavation. On balance, though, since cereals are prolific phytolith producers, if they had been brought in large amounts into the cave, they would have somehow managed to leave their traces in the phytolith record on a more massive scale than we actually have. The macroremains analysed (Margiris, this volume) are also in agreement, showing poor husk recovery from cereals.

Finally, we should comment on the front part of the cave that is missing today because of the work that has been done in the 1960s to accommodate tourism. This could have yielded the richest evidence for activity in the entire cave: it would have been the area closest to the entrance (following the geomorphological profile of the hill) with both air and light. Had a stable existed, then it would have been located in that part of the cave. Cereal processing also could have taken place close to the exit.

Constructional practices and uses of plant material

Hearths are a constructional feature of the cave. Several hearths have been analysed from both the interior and the anterior. The B1 and $\Theta 14$ hearths exhibit both similarities and differences. The hearths excavated at the lower levels of B1 are set on basal paving stones on the natural clay floor of the cave. The same practice was followed in $\Theta 14$ and Z24, but instead of stones, sherds were used to support the hearths. The use of sherds, if not symbolic, may be due to a desire to avoid the massive effort that would have been required to carry the stones into the cave’s interior.

It is worth noticing that the stone-constructed hearths of B1 are dated to the MN period and the sherd-constructed ones of $\Theta 14$ to FN. This continuation of the same essential practice may demonstrate a memory, perhaps related to the use of these hearths for special events or activities.

By contrast, the hearths excavated at the B3 and Petrocheilou sections do not share any of the aforementioned characteristics. None of these hearths are placed on stones or have been constructed in any way. They are not related to burials and none preserved any dung remains. Wood was the major fuel material. Since the wood phytoliths recovered are very poor, we infer that the tree species used for fuel were not prolific phytolith producers. In general the woody parts of plants produce minor amounts of phytoliths, and some species produce none at all (Albert 2000; Tsartsidou *et al.* 2007). This is the case for many archaeological sites. Interestingly there is also ethnographic evidence showing a lack of phytoliths in fires that used wood for fuel (Mallol *et al.* 2007).

Clay floors/platforms have been excavated in $\Theta 14$ and Petrocheilou sections. The one analysed at $\Theta 14$ preserves remains of grass straw, perhaps as a binder in the clay. On the other hand, the clay constructions in the Petrocheilou section preserve ash remains. Ash may also have been added to the clay, perhaps to impart greater stability to the construction. Alternatively, it could be the remains of some process that took place on top of the platforms.

A preferred material for constructions was reeds, as indicated by the phytoliths found in all the sediments. Reeds are very useful for making mats that could cover the wet, muddy floor of the cave. Such could also have been used for containers and making fences. Secondly, they could have been used for fuel. Sedges are rare in the sediments, implying that they were less used – maybe only for basketry. It has been shown ethnographically that baskets made of sedges were used to carry the dung in pastoral societies (Forbes 2013). Since the sedges are mostly found together with the cereal seeds, could this indicate the use of baskets of sedges to carry cereals for consumption or short-term storage? The wet environment of the cave would not permit lengthy storage in such sensitive organic containers.

Subsistence strategies

Although a variety of plants were used by the Alepotrypa occupants, the phytolith assemblages are not as rich as those recovered from Neolithic tell sites in Greece (*e.g.*, Makri in Thrace provided millions of phytoliths). This could suggest that Alepotrypa was less intensively used, or that the character of this use was not similar to the agro-pastoral way of living on a tell. The agricultural remains of the cave, *i.e.*, the by-products of cereal cultivation, are very poor. They are almost absent from the dung-rich sediments. The majority of grasses identified belong to wild species. This may suggest that if agriculture was performed it was on a small scale not producing

rich cereal by-products for fodder. The minor presence of the latter in the cave indicates that the people did not perform any cereal processing in the cave. If they were agriculturalists, they performed all such practices outside and the only products they brought into the cave were seeds already dehusked and processed. As has been published (Tsartsidou *et al.* 2007), the dehusked seeds are devoid of phytoliths. Another possibility is that cereal processing may have been performed either outside or in the front part of the cave, which is no longer preserved today. Nevertheless, since some small amounts of by-products are seen in a few hearth layers in the cave, small-scale food preparation for immediate consumption purposes may have taken place inside.

By contrast, the dung-rich sediments of the inner part and the dung identified in some of the sediments of section B1 suggest that the people of Alepotrypa owned animals. The dung used most probably had been composted, *i.e.*, accumulated and stored for a year. This is suggested by the similarities observable with composted dung of modern sheep. The composted and dried dung would have been lighter than the fresh dung: it was therefore easier to carry into the interior of the cave, and also easier to burn. The poor preservation of the spherulites indicates the acidic environment created in a stable (Macphail *et al.* 2004), where the dung originated. The stable might have been located outside the cave, but the possibility that the destroyed front part of the cave was used as a stable or as an area where dung was accumulated cannot be excluded.

The phytoliths identified in the dung-rich sediments provide some evidence about the livestock diet and consequently on the types of livestock kept. The plants are mainly wild grasses, Pooideae, Panicoideae and Chloridoideae. The Chloridoid grasses have been ethnographically (Tsartsidou *et al.* 2008) and archaeologically (Valamoti 2004, Tsartsidou *et al.* 2009) related to dung. Grazers (sheep and cattle) eat the short Chloridoid grasses in contrast to the browsers (goats) that prefer tall Pooideae grasses and leaves from dicot bushes and trees. The latter constitute a minor component of the dung sediments, even though those plants existed in the area (they were present in high frequencies in the ashy layers of the combustion features). This suggests that the livestock kept consisted mainly of sheep, with some cattle and a few goats. The similarity in the organic component of the modern composted sheep-dung to that in the Alepotrypa black sediment enhances the argument that the flocks were composed mainly of sheep.

One may thus observe that the subsistence of the site as it is reflected in the phytolith assemblages was not related to large-scale agriculture. Pastoralism rather seems to have comprised a strong component in their life-style. But it cannot explain the special finds from the cave. A specialised use of the interior of the cave may have been the major reason for what we see. On present evidence, a special use of the interior of the cave, perhaps related

to ritual, may be suggested: the construction of floors and platforms, the construction of hearths in a way that shows a continuum of memory for hundreds (if not thousands) of years, the fine quality and unused lithics, the deliberately fragmented and selectively deposited pottery that again shows no evidence of use, and the scatter of human bones all argue positively for such an interpretation. The lack of evidence for clear domestic, pastoral, or agricultural use, as well as the difficulty of access through an atmosphere heavy in dense smoke, pungent with the smell from burning dung, reinforces this view. Symbolic and ritual activities related to the dead and/or the water preserved at the back of the cave cannot be excluded. The large dark chamber that preserves the lake even today exudes an atmosphere that is appealing and, at the same time, dramatic.

Conclusions

Alepotrypa Cave preserves a variety of plants, composed of their woody parts, the fruits and leaves of trees, reeds, sedges and seeds of wild grasses. They were valued for fuel and for consumption, as well as for other day-to-day activities. The economy of the small society of Alepotrypa had a strong pastoral component as the sediments, which are rich in dung, indicate. The agricultural component is less evident; only a minor presence of cereals has been identified. Some agricultural practices may have taken place outside the cave or in the front part that was destroyed during construction. Short-term storage and processing related to immediate cereal consumption took place inside the cave. The major element of the site's continuity of use may have to do with the special use of the interior, where the lake is. This thesis is supported by many different lines of evidence – cultural, osteoarchaeological, geoarchaeological and archaeobotanical – as indicated in other chapters of this volume. Analyses on all these fronts combine to suggest that different usages were made of the interior and anterior portions of the cave, ones that could be related to ritual or symbolic activities and that lasted for thousands of years.

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Bibliography

- Albert, R. M. (2000) *Study of Ash Layers through Phytolith Analyses from the Middle Palaeolithic Levels of Kebara and Tabun Caves*. Unpublished PhD. thesis, University of Barcelona.
- Albert, R. M. and Weiner, S. (2001) Study of phytoliths in prehistoric ash layers using a quantitative approach. In J. D. Meunier and F. Colin (eds) *Phytoliths: Applications in Earth Sciences and Human History*, 251–266. Lisse.
- Canti, M. G. (1999) The production and preservation of faecal spherulites: animals, environment and taphonomy. *Journal of Archaeological Science* 26, 251–258.
- Gur-Arieh, S., Mintz, E., Boaretto, E. and Shahack-Gross, R. (2013) An ethnoarchaeological study of cooking installations in rural Uzbekistan: Development of a new method for identification of fuel sources. *Journal of Archaeological Science* 40, 4331–4347.
- Forbes, H. (2013) Off-site scatters and the manuring hypothesis in Greek survey archaeology: An ethnographic approach. *Hesperia* 82, 551–594.
- Gourgiotis, L., 1994. Construction and use of bonza in Thessaly. In 'Our Bread' from Wheat to Bread, 205–211. Athens (in Greek).
- Hillman, G. C. (1981) Reconstructing crop husbandry practices from charred remains of crops. In R. Mercer (ed.) *Farming Practice in British Prehistory*, 123–162. Edinburgh.
- Macphail, R. I., Cruise, G. M., Allen, M. J., Linderholm, J. and Reynolds, P. (2004) Archaeological soil and pollen analysis of experimental floor deposits; with special reference to Butser ancient farm, Hampshire, UK. *Journal of Archaeological Science* 31, 175–191.
- Madella, M., Alexandre, A. and Ball, T. (2005) International code for phytolith nomenclature I. *Annals of Botany* 96, 253–260.
- Mallol, C., Marlowe, F. W., Wood, B. M. and Porter, C. C. (2007) Earth, wind, and fire: Ethnoarchaeological signals of Hadza fires. *Journal of Archaeological Science* 34, 2035–2052.
- Piperno, D. R. (2006) *Phytoliths: A Comprehensive Guide for Archaeologists and Paleoecologists*. Lanham.
- Schiegl, S., Goldberg, P., Bar-Yosef, O. and Weiner, S. (1996) Ash deposits in Hayonim and Kebara caves, Israel: macroscopic, microscopic and mineralogical observations, and their archaeological implications. *Journal of Archaeological Science* 23, 763–781.
- Schiegl, S., Lev-Yadun, S., Bar-Yosef, O., Goresy, A. E. and Weiner, S. (1994) Siliceous aggregates from prehistoric wood ash: a major component of sediments in Kebara and Hayonim Caves (Israel). *Israel Journal of Earth Sciences* 43, 267–278.
- Shahack-Gross, R. (2011) Herbivorous livestock dung: formation, taphonomy, methods for identification and archaeological significance. *Journal of Archaeological Science* 38, 205–218.
- Tsartsidou, G., Lev-Yadun, S., Efstratiou, N. and Weiner, S. (2008) Ethnoarchaeological study of phytolith assemblages from an agro-pastoral village in Northern Greece (Sarakini): Development and application of a phytolith difference index. *Journal of Archaeological Science* 35, 600–613.
- Tsartsidou, G., Lev-Yadun, S., Efstratiou, N. and Weiner, S. (2009) Use of space in a Neolithic village in Greece (Makri): Phytolith analysis and comparison of phytolith assemblages from an ethnographic setting in the same area. *Journal of Archaeological Science* 36, 2342–2352.
- Tsartsidou, G., Lev-Yadun, S., Albert, R. M., Rosen, M. A., Efstratiou, N. and Weiner, S. (2007) The phytolith archaeological record: strengths and weaknesses evaluated based on a quantitative modern reference collection from Greece. *Journal of Archaeological Science* 34, 1262–1275.
- Valamoti, S. M. (2004) *Plants and People in Late Neolithic and Early Bronze Age Northern Greece. An Archaeobotanical Investigation*. (British Archaeological Report S1258). Oxford.

Wood charcoal analysis from the sediments of Alepotrypa Cave

Maria Ntinou

Introduction

Wood charcoal macro-remains are a very characteristic feature of the sediments at Alepotrypa Cave, especially of those in the interior chambers. This fact was observed by the excavators during the early campaigns; many samples representing most of the excavated areas were recovered. The most recent excavations also focused on the study of different categories of archaeobotanical materials from the cave. For this purpose various sediment samples were processed with the flotation technique during the short campaigns from 2011 to 2014, which were targeted to reassess specific points regarding the cave's history and use.

Wood charcoal remains are generally commonplace in archaeological deposits. In destruction layers, wood charcoals are the remains of burnt wooden structures, furniture and other wooden implements. However, in the majority of all other types of contexts wood charcoals are the remains of firewood collected from the natural environment and burnt in hearths (Chabal 1997). As such they represent the material residues of a complex interplay between long-term environmental change, localised ecological/vegetation processes, economic production and cultural formations (Asouti and Austin 2005). Wood charcoals may be found directly associated with burnt features or they can be scattered in sediments and fills that accumulated over time as a result of the repeated cleaning and dispersal of hearth remains. In the latter case, wood charcoal remains represent a longer-term collection of the plant species available in the environment: through systematic analysis they may provide a precise picture of the local vegetation, the plant formations to which the identified plant species correspond and their transformation through time (Chabal *et al.* 1999, 61–63). Moreover, the

results can be directly correlated with the archaeological context, therefore linking prehistoric subsistence patterns with their environmental setting.

At Alepotrypa, the wood charcoal material studied and here presented comes from Chambers B, D, Z and from the Chamber of Lakes. These locales represent two different modes of space usage. Chamber B, on the one hand, is located close to the entrance of the cave: it was probably a 'short-term' living area, but utilised repeatedly over a long period of time starting during the end of the Early Neolithic (EN) and finishing in the Final Neolithic (FN). In contrast, all the other areas located in the interior of the cave constituted a ritualistic setting with human bone scatters, massive quantities of fine pottery and distinctive layers of burnt organic materials, of late EN and later date.

Consequently, a two-fold enquiry was possible regarding the study of the wood charcoal remains:

- A) to investigate the local vegetation setting at different periods in the habitation history of the cave as this is revealed in Chamber B. To this end, the analysis of samples from the long sequence in Trenches B1 and B1a provides a precise picture of the composition and changes in the local vegetation catchments through time, along with information about the firewood procurement strategies and woodland management by the Neolithic groups that used the cave.
- B) to attempt to shed some light on the elusive ritualistic activities that took place in the interior of the cave, which – as indicated also by the selective deposition there of closed, fine ware pots – may have influenced the selection of fuel types, the woody species and modes of their use and deposition.

The vegetation

The Mani Peninsula where Alepotrypa Cave is located is mainly characterised by Mediterranean sclerophyllous vegetation that includes communities of xeromorphic evergreen tree and shrub species especially of the genera *Quercus* (subgenus *Sclerophyllodrys*), *Pistacia*, *Juniperus*, *Olea* and *Pinus*. The area of the cave forms part of the thermo-mediterranean belt that extends over the coastal hill country of the Peloponnese: this is characterised by Oleo-Ceratonion vegetation with secondary mass occurrence of *Pistacia lentiscus* and *Quercus coccifera*. Depending on topography, anthropogenic activities, soil types and exposition, such vegetation presents great variability in density and composition from thick woodland to the much more common open stands that naturally occur on steep slopes and mainly arise from various forms of use and misuse (timber removal, grazing, fire) (Bohn *et al.* 2000/2003).

Inland of the coastal areas, in the moister and higher localities of the Peloponnese, there exists a meso-mediterranean evergreen woodland with *Quercus coccifera*, *Arbutus unedo*, *A. andrachne*, *Cercis siliquastrum*, *Pistacia terebinthus*, *Erica*, *Phillyrea latifolia*, etc. *Quercus ithaburensis* subs. *macrolepis* is locally important and *Fraxinus ornus* can be found in montane localities. On the northern part of the Mani Peninsula, the southernmost supra-mediterranean conifer forests grow on the Taygetos Mountain. *Pinus nigra* extends between 1,100–1,650 m and *Abies cephalonica* forms forests on metamorphic limestone at altitudes of 900–1,800 m. Both species may occasionally be found in mixed stands with *Erica arborea*, *Lonicera hellenica*, *Juniperus oxycedrus*, *Crataegus heldreichii*, *Crataegus pycnoloba*, *Prunus cocomilia*, *Quercus coccifera* and *Phillyrea latifolia* growing in the shrub layer. Finally, on the mountain summits oroxerophytic vegetation grows with *Astragalus angustifolius*, *A.* subgen. *Tragacantha* spp., *Acantholimon ulicinum*, *Daphne oleoides*, *Sideritis clandestine* and *Asperula boissieri* (Bohn *et al.* 2000/2003).

Materials and method

Wood charcoal samples from Alepotrypa Cave were recovered during the excavation campaigns of the 1970s, 1980s and 1990s and again from 2011 to 2014. These represent all the different areas investigated, namely Trenches B1 and B1a in Chamber B, locations Θ 9, Θ 10 and Θ 14 in Chamber D, locations Z22 and Z24 in Chamber Z and two locations, LA 1 and LAN in the Chamber of Lakes. Plenty of samples were collected during the early excavations, especially from Trench B1 and location Z22, but the recovery method is not known. Sediment samples were recovered from all the contexts investigated from 2011 to 2014; the archaeobotanical remains were separated with the flotation technique.

As already mentioned, the abundant wood charcoal remains correspond to both habitation and ritualistic activities. They reflect firewood procurement strategies carried out over a long time span from the beginning of the 6th to the end of the 4th millennium cal BC. Therefore, the study of this material could be expected to shed light on the palaeoenvironmental characteristics of the area, by providing information first on the local vegetation and its management by Neolithic groups through time and also on the role of fire and firewood, apparently indispensable elements of the mortuary practices and gatherings in the interior of the cave.

To this end we selected and analyzed 125 samples originating from different contexts. Table 19.1 shows in detail the provenance and distribution of the studied samples. Not surprisingly, the majority of the samples come from Trench B1 in which the complete habitation sequence of the cave was recorded. Many samples were also recovered from location Θ 14, where a layer comprising successive hearth features and floors, comprising a compressed stratigraphic sequence of c. 50 cm, was excavated (see Karkanas, this volume). All the samples available from Θ 9, Θ 10 and Z24 were analysed, while only a selection from Z22 and LA were treated, the choice mainly depending on the abundance of remains in each bag/sample.

The flotation technique was applied to the sediment samples collected during the excavation campaigns of 2011–2014. For wood charcoal analysis the materials from both the flot and the heavy residue were used. As stated above, the recovery technique for the samples from the earlier excavations is unknown. In most samples the remains were abundant; generally fragments > 3 mm were separated for analysis.

The botanical identification of woody plant taxa is based on the characteristic microscopic anatomical structures of their xylem, which are preserved when the wood is carbonised (Figures 19.1 and 19.2). Each wood charcoal fragment was hand-fractured in order to obtain the required three anatomical sections (transverse, tangential

Table 19.1. Provenance, cultural correlation and number of fragments of the studied wood charcoal samples

Location	Chamber	Phase	No. samples	No. frags
Trench B1a	B	FN	12	403
Trench B1	B	LN	35	436
		LN/MN	19	101
		late EN	5	23
TH9	D	LN–FN	8	34
TH10			5	38
TH14			22	758
Z22	Z	EN–FN	8	235
Z24		FN–LN	2	116
LA 1/215 & 216	Lakes	FN–LN	7	160
LAN/305 & 306			2	99
Total			125	2,403

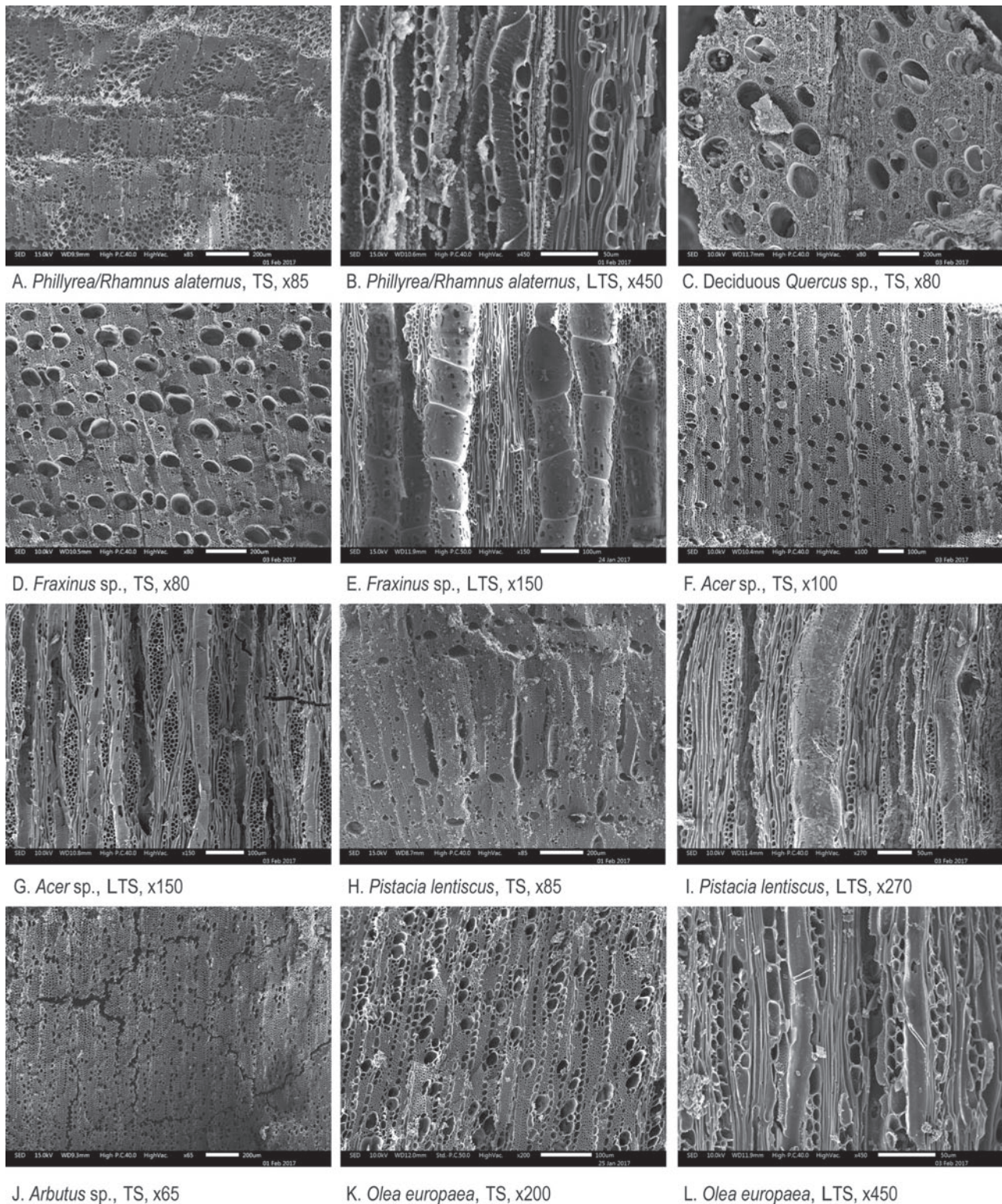


Figure 19.1. Anatomy sections of some of the identified taxa. TS: transverse section, LTS: longitudinal tangential section, LRS: longitudinal radial section.

longitudinal and radial longitudinal). The xylem structure and elements were scrutinised with a microscope and identified as to plant families, genera and species (Chabal *et al.* 1999, 45–47). For the botanical identification of the

wood charcoal samples from Alepotrypa, the facilities of the M.H. Wiener Laboratory for Archaeological Science of the ASCSA were used, including a Leica DM LM metallurgical microscope with incident bright field/dark

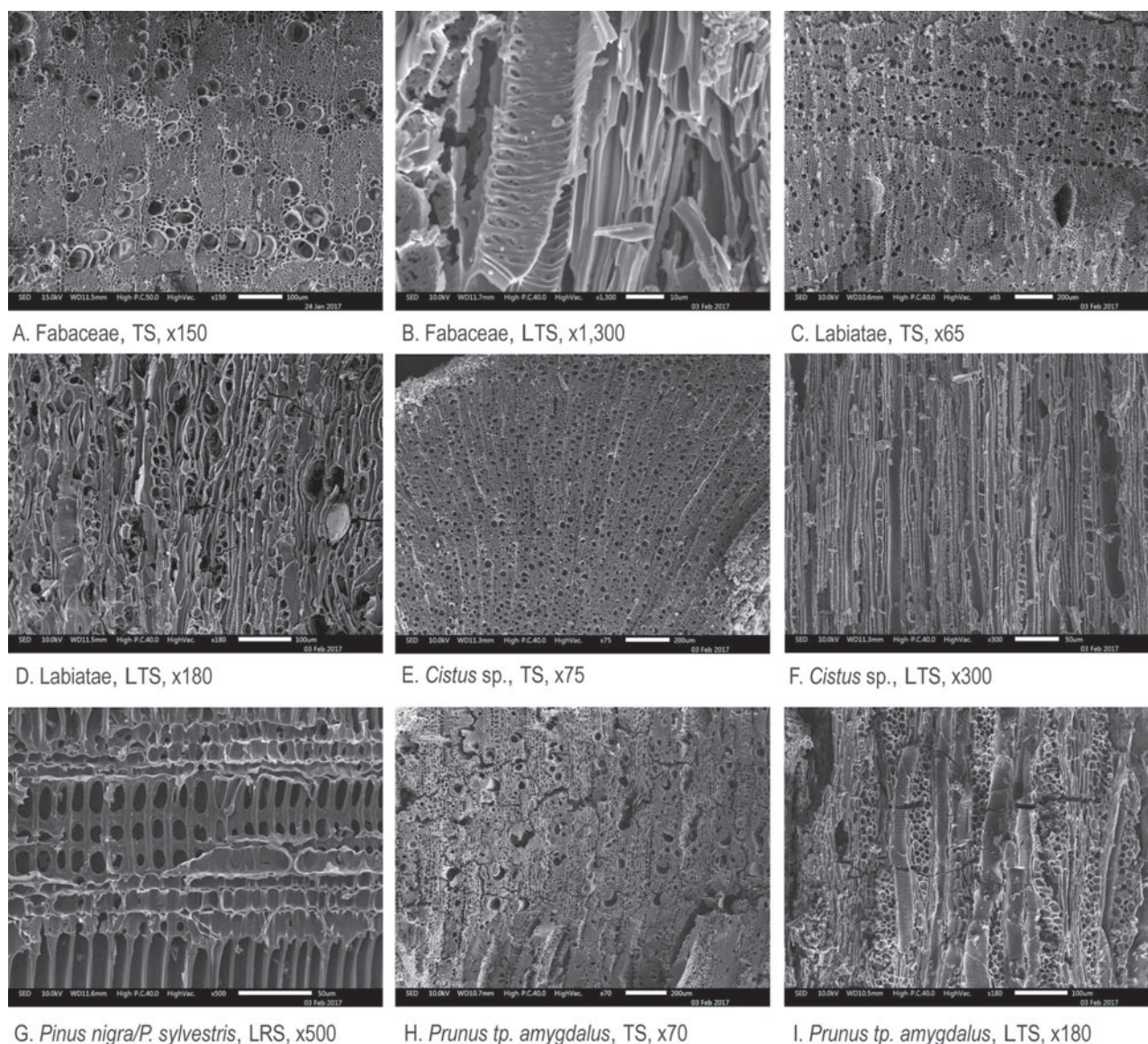


Figure 19.2. Anatomy sections of some of the identified taxa. TS: transverse section, LTS: longitudinal tangential section, LRS: longitudinal radial section.

field lighting and $\times 5$, $\times 10$, $\times 20$, $\times 50$ and $\times 100$ objectives, a reference collection of modern carbonised wood and the Crivellaro and Schweingruber (2013) and Schweingruber (1990) plant anatomy atlases.

In the majority of cases the archaeobotanical specimens were only identified down to genus level, due to the great anatomical similarity of the species in some genera. However, some plant species could be recognised, while an equal number of specimens could only be attributed to their plant families. The prefix 'cf' indicates that a specimen bore a strong similarity to a particular genus, species or family, but the full criteria for the identification were missing. Recording of dendrological characteristics (curvature, annual rings and presence of pith/bark) and state of the wood (fungi, boreholes) was carried out following Marguerie and Hunot (2007).

The wood charcoal assemblages from the different locations studied (Trench B, Trench B1a, Θ 14, Z22, Z24, LA) are composed of the total number of samples, flotation or other, recovered in each one of them. As already mentioned, different recovery strategies were applied at various times in the retrieval of samples from their contexts. Therefore, in order to be able to make comparisons between assemblages and to compensate for the possible biases caused by different recovery methods, we considered it appropriate: a) to attempt to group the identified taxa into different vegetation types according to their environmental requirements – this would help distinguish the possible use and exploitation of different areas within the catchment of the site; and b) to carry out frequency of occurrence analysis for the taxa from each one of the assemblages (Asouti and Austin 2005). The

latter tactic allows differences in the frequency of use of the taxa to be distinguished, which could be related to deliberate choice, vegetation availability and change, or again to changes in the procurement modes: all matters of particular significance since variable usage of the cave environment is indicated. The quantity values of the identified taxa in the wood-charcoal assemblages have been measured as percentages of fragment counts (Chabal *et al.* 1999) in order to investigate any quantifiable changes in taxa through time that could be related to vegetation change and the intensity of firewood exploitation.

Results

Flora, vegetation and firewood availability

In total, 2,403 wood charcoal specimens were subjected to analysis for botanical identification. At least 21 plant taxa were identified (Figures 19.1 and 19.2), namely *Abies* sp. (fir), *Acer* sp. (maple), *Arbutus* sp. (strawberry tree), *Cistus* sp. (rock rose), cf. *Compositae*, cf. *Erica* (heath), *Fabaceae* (legume undershrubs), *Ficus carica* (fig tree), *Fraxinus* sp. (ash), *Juniperus* sp. (juniper), *Labiatae* (mint family), *Maloideae* (wild pear family), *Olea europaea* (olive), *Phillyrea/Rhamnus alaternus* (mock privet/buckthorn), *Pinus nigra* (black pine), *Pistacia lentiscus* (lentisk), *Pistacia terebinthus/P. atlantica* (terebinth), *Prunus amygdalus/P. webbii* (almond/wild almond), *Prunus spinosa* (blackthorn), deciduous *Quercus* sp. (deciduous oak), and evergreen *Quercus* sp. (prickly oak/Holm oak).

The identified taxa are all native to the flora of the Peloponnese and at present they form part of several vegetation types, which grow in successive bioclimatic zones from the lowland coastal areas of the Mani Peninsula ascending to the Taygetos Mountain bordering it to the north. According to the environmental requirements of the identified taxa, one group can be clearly distinguished: it includes the Mediterranean mountain conifers, the black pine (*Pinus nigra*) and the fir (*Abies* sp.) (Table 19.2), that would not have grown locally in the surroundings of the cave. These taxa represent the coniferous forests, with *Pinus nigra* and *Abies cephalonica*, that characterise the supra/oro-mediterranean bioclimatic zone on the Peloponnesian mountains (Barbero and Quezel 1976, 30–32, 46; Quezel and Barbero 1985) and more specifically Taygetos, lying directly to the north of the Mani Peninsula (Dafis 2010, 57, 117, 123; Polunin 1980, 47).

In contrast to these high altitude mountain taxa, the rest identified are very characteristic of all lowland and mid-altitude areas of the Mani Peninsula. A second group includes scrub vegetation and undergrowth such as the *Fabaceae*, *Labiatae*, *Cistus*, *Erica* and *Compositae* (Table 19.2), which commonly form *garrigue* vegetation in lowland and coastal areas and will include in their make-up *Calicotome*, *Coronilla*, *Salvia*, *Phlomis*, *Cistus*, *Erica*, etc. (Polunin 1980, 36–42). These shrubs could have

formed a dense low mantle on the rocky ground above the cave and also have grown in association with small trees such as the blackthorn (*Prunus spinosa*), the almond (*Prunus amygdalus*) or the wild almond (*Prunus webbii*), the juniper (*Juniperus* sp.) and species of the *Maloideae* family, such as the wild pear (*Pyrus amygdaliformis*), one of the most drought-resistant trees of southern Greece (Rackham 1990; Turland *et al.* 1993). All these sun-loving, poor-soil colonisers together with the scrub undergrowth would have formed patches of open woodland on the abrupt, stony slopes around the cave.

Another group would have included various tree taxa, both evergreen and deciduous, such as prickly/Holm oak, deciduous oak, *Phillyrea/Rhamnus alaternus* (mock privet/buckthorn), maple, strawberry tree, terebinth and lentisk, fig and olive (Table 19.2). In the Peloponnese, these are commonly found in Mediterranean evergreen oak woodland, in mixed woodland or *maquis* vegetation in several sub-associations from the coastline up to 1,200 m asl (Barbero and Quezel 1976, 14–16). Wood charcoal analysis cannot distinguish between different species of oak but can clearly indicate whether a specimen belongs to the evergreen (*Quercus coccifera* or *Quercus ilex*) or the deciduous species. In the samples from Alepotrypa Cave it is possible that both evergreen species are represented. However, *Quercus coccifera* is less demanding in humid and edaphic conditions compared to *Quercus ilex*, and for this reason it has a broader ecological distribution (Polunin 1980, 32). It can be found from the most arid and hot coastal zone (where it forms scrubland and/or woodland with lentisk, strawberry tree, mock privet and wild olive) to the warmest zone of deciduous forests (where it lives in mixed woodland zones with ash and deciduous oaks such as *Q. pubescens*) (Dafis 2010, 69). Therefore, the evergreen oak remains from Alepotrypa could belong to *Q. coccifera*, which would have grown in the area together with all the other evergreen taxa and, especially, *Phillyrea*. In the case of the last there again exists an ambiguity in the wood charcoal analysis since the wood anatomy of *Phillyrea* is very similar to that of *Rhamnus alaternus*. We suspect that it is mostly *Phillyrea* that is represented in the samples from Alepotrypa Cave, since *Phillyrea media* and *P. latifolia* are at present very common in evergreen woodland (Polunin 1980, 31–33) and appear to have been so since early in the Holocene in coastal areas of the Balkans (Sadori *et al.* 2011) and Greece (Ntinou 2011; Ntinou and Stratouli 2012). For the southern Peloponnese in particular, the sub-association *Querco-Phyllireetum mediae* is recorded with *Quercus coccifera*, *Phillyrea media*, *Acer orientalis*, *Pistacia palestina* and *Arbutus*, which have all been identified in the samples from Alepotrypa Cave (Barbero and Quezel 1976, 14). The understorey of the evergreen woodland or its less densely wooded borders would have also been covered by low scrub vegetation. In addition to *Phillyrea latifolia*, *Quercus coccifera*, *Arbutus*, and

Table 19.2. Frequency of occurrence (ubiquity) of the taxa in the samples that comprise the assemblages of different locations and/or cultural phases

TAXA	B1 – FN		B1 – LN		B1 – LN/MN		B1 – late EN		Ø 9 & Ø 10		Ø 14		Z22 & Z24		LA & LAN	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
<i>Abies</i> sp. cf. <i>Abies</i> <i>Pinus nigra</i>	1	5.3									1	4.5			1	11.1
<i>Fraxinus</i> sp.																
<i>Quercus</i> sp. deciduous	1	8.3	17	48.6	6	31.6	1	20.0	2	15.4	2	9.1	6	60.0	1	11.1
<i>Quercus</i> sp. evergreen	11	91.7	8	22.9	3	15.8			3	23.1	13	59.1	3	30.0	5	55.6
<i>Phillyrea/Rhamnus alaternus</i>	11	91.7	18	51.4	4	21.1	2	40.0	5	38.5	18	81.8	9	90.0	6	66.7
<i>Acer</i> sp.			1	2.9	2	10.5					1	4.5				
<i>Arbutus</i> sp.	3	25.0	4	11.4	1	5.3										
<i>Ficus carica</i>											1	4.5				
<i>Pistacia terebinthus/P. atlantica</i>	1	8.3	6	17.1	2	10.5	2	40.0			1	4.5				
<i>Pistacia lentiscus</i>					1	5.3					1	4.5	1	10.0	1	11.1
<i>Olea europaea</i>	3	25.0														
<i>Prunus</i> sp. (all)	8	66.7	15	42.9	13	68.4	3	60.0	9	69.2	15	68.2	3	30.0	2	22.2
<i>Juniperus</i> sp.			1	2.9							1	4.5				
<i>Malloideae</i>			1	2.9	1	5.3	1	20.0							2	22.2
<i>Fabaceae</i>	10	83.3	19	54.3	3	15.8			4	30.8	20	90.9	8	80.0	8	88.9
<i>Labiatae</i>	3	25.0	9	25.7	5	26.3	1	20.0	2	15.4	2	9.1	7	70.0	7	77.8
<i>Cistus</i> sp.													4	40.0	5	55.6
cf. <i>Compositae</i>	1	8.3														
Total n of samples	12	100	35	100	19	100	5	100	13	100	22	100	10	100	9	100

(n = number of samples in which each taxon is present in a given assemblage, % = frequency of occurrence as percentage of samples in which each taxon is present in a given assemblage). Relative frequencies are indicative of the frequency of use of each taxon. To the left of the taxa column the identified taxa are tentatively grouped in vegetation types.

Acer sempervirens, Mediterranean evergreen forests in Greece also include a variety of Fabaceae (*Calicotome*, *Coronilla*), and Labiatae (*Salvia*, *Phlomis*, *Thymus*, etc.) shrubs (Polunin 1980, 31–33).

The deciduous oak specimens from Alepotrypa Cave could belong to the leathery-leaved deciduous Valonia oak, *Q. ithaburensis* subsp. *macrolepis*, splendid representatives of which can be seen at present growing in the lowlands of the Mani Peninsula from Gytheio to Kardamyli. This sun-loving, drought-resistant oak species (Dafis 2010, 95), which requires warm winters, may have formed open woods with scattered trees (Polunin 1980, 43), including other deciduous trees, such as the manna ash, which has been identified at Alepotrypa, or evergreen species and herbaceous undergrowth. Mediterranean evergreen woodland or mixed thickets would have grown close to the cave on deeper soils and in areas that at present are barren, possibly due to heavy grazing (see Hadjikoumis, this volume) and the effect of fire over the centuries or where the natural vegetation has been substituted by extended olive groves.

Regarding the presence/absence of the identified taxa in different contexts and their frequency of occurrence (Table 19.2), the following observations can be made. Scrub vegetation, in particular plants of the Fabaceae and Labiatae genera, was systematically used for firewood both in habitation and ritualistic contexts. In the latter, Fabaceae and Labiatae are among the most frequently used taxa accompanied by rockrose (*Cistus* sp.), a taxon almost exclusively present in the interior locations Z22, Z24, LA 1 and LAN. The open vegetation that would have probably grown on the limestone slopes around the cave and which is represented by several *Prunus* species, juniper and Maloideae, was frequently used in all the habitation phases, but rather less so in the interior chambers. That the wooded areas within the cave's catchment were systematically used is indicated by the constant presence of their constituents in all contexts and by the high frequency of occurrence of *Phillyrea/Rhamnus alaternus*, deciduous oak and prickly/Holm oak. In the habitation sequence of the cave, there is an increasing tendency towards greater frequency of their use from the earlier to the later periods. Another observation worth mentioning is the almost complete absence of the olive from the different contexts, irrespective of the character of its usage. This taxon appears only in the topmost part of the sequence dated to the FN. The scarcity of the taxon in the sediments from the cave contrasts with the characterisation of the coastal thermo-mediterranean zone where the site is located, which includes numerous examples of the olive and the carob (Dafis 2010; Polunin 1980; Quezel and Barbero 1985). Its most distinctive feature, the olive, is missing from most parts of the Neolithic sequence at Alepotrypa. Finally, the Mediterranean mountain conifers, and in particular the black pine, tend to be concentrated in the locations in the interior of the cave, to which a

ritualistic usage is attributed. In the habitation area of Chamber B, the presence of these taxa is not recorded: with the exception of fir in one sample of the LN/MN layers of the sequence.

Vegetation during the Neolithic period and domestic firewood use

The habitation usage of the cave has been recorded in the chambers located closer to the entrance, chambers A and B. Trenches B1 and B1a in Chamber B preserve a record of the entire habitation sequence of the cave starting during the late Early Neolithic and ending abruptly at the end of the Final Neolithic, or a bit later, possibly due to the collapse of the entrance. The stratigraphical sequence of the habitation area comprises five major cultural phases: late Early Neolithic (EN) (c. 6,000 cal BC), Middle Neolithic/Late Neolithic (MN/LN) (c. 5500 cal BC), Late Neolithic (LN) (c. 5,500–4,500 cal BC), LateNeolithic/Final Neolithic (LN/FN) (disturbed) and Final Neolithic (FN) (c. 4,500–3,200 cal BC). Most of the FN and LN sequence was dug during the earlier excavations and although many wood charcoal samples were recovered from the lower part of the LN phase, below 2.80 m depth, there were no samples from its upper part or the FN layers. Recent investigations in the cave have partly filled this gap: work in Trench B1a has documented the FN part of the sequence. Moreover, further and deeper excavation in Trench B1 recovered archaeobotanical remains from the transitional MN/LN layers and the underlying late EN fill. Thus and taken together, the habitation layers in Trenches B1 and B1a, where firewood remains are found scattered throughout the deposits, provide good documentation of the characteristics both of the local vegetation and of the firewood procurement strategies of the Neolithic communities during the whole period from c. 6,000 to 3,200 cal BC.

Table 19.3 presents the results from each of the major phases of the cultural sequence with the exception of the upper part of the LN, from which no samples were recovered. The samples that make up the assemblage of the LN phase were recovered from layers below the depth of 2.80 m: thus they can be considered older than 4990–4780 cal BC (OxA-29275; 5982 ± 36 BP: the date from layer 9 at 2.75 m depth). The FN and the LN assemblages include a large number of remains; fewer specimens comprise the groups from the two earlier phases, since the excavated area was very restricted. The absolute number of remains of each taxon in the assemblages is shown, while the frequency values (% fragment counts) of the taxa are calculated only for the MN/LN, LN and FN assemblages. The wood charcoal fragments from the late EN set are too few for any worthwhile quantification.

The results presented in Table 19.3 and Figure 19.3 indicate that different vegetation types existed in the catchment area of the site and that all were used by the Neolithic community for the procurement of firewood:

Table 19.3. Results for the anterior part of the cave, Trenches B1 and B1a, where habitation usage is documented

Phase	Late EN (c. 6,000 cal BC)		LN/MN (c. 5,500 cal BC)		LN (dates?) 2.80–4.00		FN (4,500–3,200 cal BC)	
Depth (m)	4.60–4.80		4.00–4.60				0–1.20	
Taxa	n frags		n frags %		n frags %		n frags %	
<i>Abies</i> sp.			1	1.0				
<i>Fraxinus</i> sp.	1						2	0.5
<i>Quercus</i> sp. deciduous type	4		7	6.9	74	17.0	31	7.7
<i>Quercus</i> sp.			4	4.0	28	6.4	24	6.0
<i>Quercus</i> sp. evergreen type			3	3.0	32	7.3	56	13.9
<i>Phillyrea/Rhamnus alaternus</i>	2		10	9.9	103	23.6	137	34.0
<i>Acer</i> sp.			2	2.0	1	0.2		
<i>Arbutus</i> sp.			2	2.0	9	2.1	4	1.0
<i>Pistacia terebinthus</i> /P. <i>atlantica</i>	2		3	3.0	14	3.2	2	0.5
<i>Pistacia lentiscus</i>			1	1.0				
<i>Pistacia</i> sp.					3	0.7		
<i>Olea europaea</i>							6	1.5
Maloideae	2		2	2.0	4	0.9		
<i>Juniperus</i> sp.					1	0.2		
<i>Prunus spinosa</i>	2				11	2.5		
<i>Prunus amygdalus</i> /P. <i>spinosa</i>			20	19.8	9	2.1	10	2.5
<i>Prunus amygdalus</i> /P. <i>webii</i>	3		18	17.8	20	4.6	18	4.5
<i>Prunus</i> sp.	4		5	5.0	5	1.1	10	2.5
cf. <i>Prunus</i>			1	1.0	1	0.2	1	0.2
<i>Prunus</i> /Rosa	2				8	1.8		
Fabaceae			5	5.0	71	16.3	73	18.1
Labiatae	1		5	5.0	13	3.0	4	1.0
cf. Labiatae			2	2.0	2	0.5		
cf. Compositae							1	0.2
angiosperm			8	7.9	22	5.0	23	5.7
bark					3	0.7		
nutshell			2	2.0	2	0.5	1	0.2
Total	23		101	100	436	100	403	100

(n = number of wood charcoal fragments, % = percentage fragment count for each taxon). Relative frequencies of taxa are indicative of the composition of the vegetation types frequented by the Neolithic groups for firewood procurement.

both open, stony-ground vegetation, probably on the steep slopes around the cave, and evergreen and mixed woodland on deeper soils. As to their frequency of use (Table 19.2), the results show that the open vegetation suite, represented mostly by several *Prunus* species, was systematically used for the entire Neolithic: the average frequency of occurrence of all *Prunus* species being around 60%. However, the frequency of these taxa in the composition of each assemblage shows a marked reduction from the earlier to the later phases (Figure 19.4).

Regarding the undergrowth, Fabaceae and Labiatae were systematically used throughout the Neolithic. The frequency of use (Table 19.2) of Labiatae is around 25% but, similar to *Prunus*, its abundance (Table 19.3, Figure 19.3) decreases from the MN/LN to the FN. Fabaceae on the other hand show the opposite trend: both the frequency of use (15–83%) (Table 19.2) and abundance (5–20%) increase through time (Table 19.3, Figure 19.3), and in the FN Fabaceae becomes the second most abundant taxon after *Phillyrea*.

Among the Mediterranean woodland taxa, the best represented both in terms of frequency of occurrence and

abundance is *Phillyrea/Rhamnus alaternus*. Alongside evergreen oak, its values increase progressively from the MN/LN Neolithic to the FN. Already during the LN, *Phillyrea/Rhamnus alaternus* is the most abundant taxon (23.7%) in the assemblage and reaches its highest values in the FN (33.3%). Evergreen *Quercus* shows the same trend with progressive increase from the earlier to the later phases, where it reaches its highest value (13.6%) and most frequent use. This is similar to *Phillyrea/Rhamnus alaternus*: both are present in 91% of the samples from the FN. Of the other evergreen taxa the frequency of use of *Arbutus* increases through time (5.3% in the MN/LN to 25% in the FN), although its abundance in the assemblages is constantly low (c. 2%). The abundance of the terebinth is overall low (c. 3%) and its frequency of use decreases with time (10–8%), while other taxa such as the maple and the Maloideae show similar trends, which would indicate their secondary role in the vegetation of the study area. Deciduous *Quercus* was quite frequently used throughout the Neolithic (on average 40% of the samples of each assemblage) and similarly to the other tree taxa it becomes more abundant from the MN/LN (8%) to LN

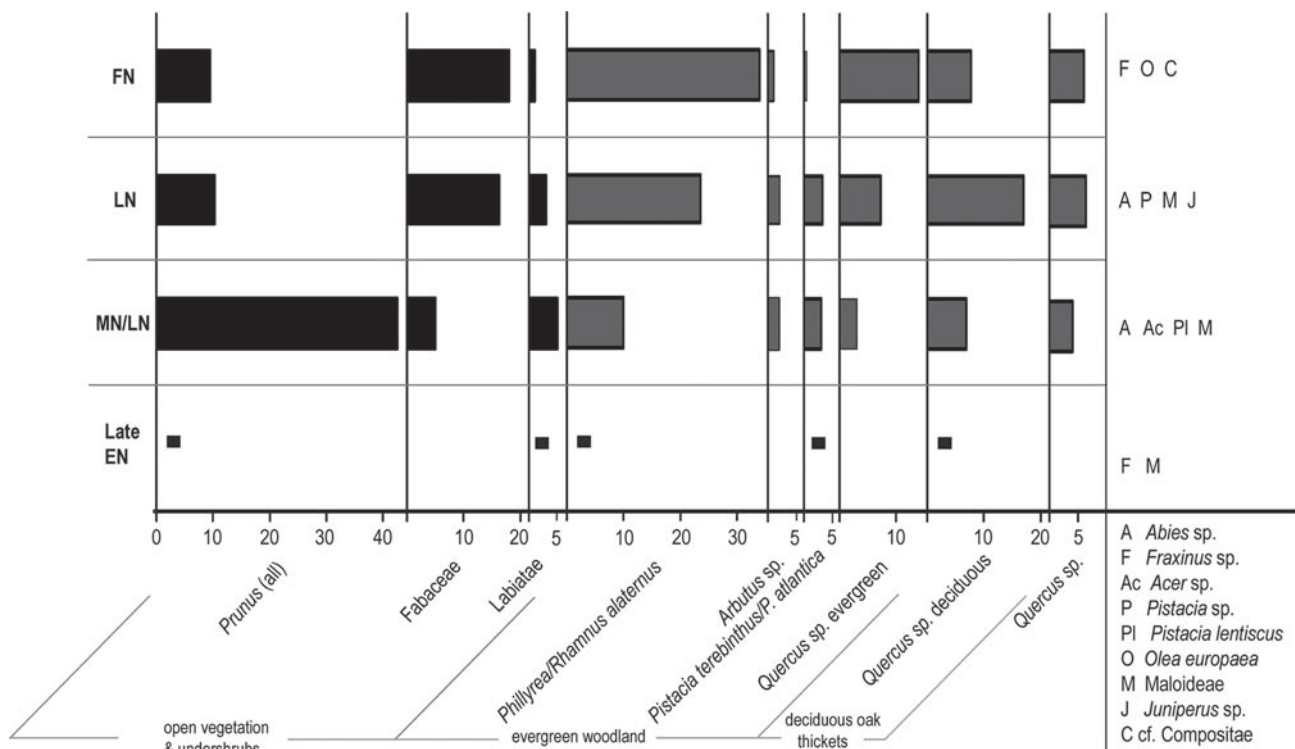


Figure 19.3. Wood charcoal diagram showing changes in the frequency of plant taxa throughout the Neolithic sequence of Alepotrypa Cave.

(17%) doubling its value, only to fall back again during the FN (7%). Finally the olive is present only in the FN and at very low percentage (1.5%) in the composition of the assemblage, pointing to a rather insignificant role in the local natural vegetation.

Regarding the composition of the different types of vegetation and the order of dominance for the different taxa (Table 19.3, Figure 19.3), the results indicate that in the open vegetation around the cave various *Prunus* species grew relatively densely in the earlier phases forming the tree level, with a rich undergrowth dominated by shrubs of the pulses family (Fabaceae) and to a lesser degree by shrubs of the mint family (Labiatae). Through time, the abundance of Fabaceae increased, accompanied by that of the Labiatae, while input from trees decreased. The open vegetation and the undergrowth remained the most frequently used fuel sources through time, probably because they were the closest to the site.

The evergreen woodland was rich in taxa among which *Phillyrea* would have been the predominant followed by the evergreen oak. The same composition has been observed at other coastal sites in Greece dated to the same period, namely the Drakaina Cave in Kephallonia (Ntinou and Stratouli 2012) and the Cave of the Cyclopes in Youra, Northern Sporades (Ntinou 2011). This image of the vegetation is not very common today, since *Quercus coccifera* dominates most Mediterranean evergreen formations. However, in the woodlands of the first half of the Holocene, when anthropogenic activity was still low, it is possible that *Q. coccifera*, instead of the dense bushy

form that we are used to seeing today, grew to be large, widely-spaced trees, something now rarely encountered (Barbero and Quezel 1976, 13). *Phillyrea* trees of smaller size would have thickly infilled the lower woodland level, above the undergrowth. Such a proliferation of these small-sized *Phillyrea* trees, set against a fewer big evergreen oaks, would have made of the former a more abundant source of firewood, either as deadwood or harvested. Deciduous oak is the third most important tree taxon and indicates the presence either of open thickets of such trees or their presence in mixed woodlands with other evergreen and deciduous taxa, like the evergreen oak, *Phillyrea*, strawberry tree and terebinth.

These results from the Neolithic sequence (Figure 19.3) show that through time scrub vegetation, mostly represented by the Fabaceae, and the Mediterranean evergreen woodland increased. This pattern points to a change in firewood procurement strategies from the LN onwards, i.e., in the systematic exploitation of different environments within the catchment of the site, rather than to a change in the vegetation available. It is true that the record for the earlier phases is very restricted and more material should be analysed in order to confirm this interpretation of the data. Nevertheless, it seems that during the earlier phases it was only the very local vegetation growing on the stony slopes around the cave that was used: such would have probably covered the demands of the few short-term visits to the cave. During the LN and the FN the visits to the cave, despite their still being of short duration, were much more frequent: the thick habitation deposits testify to this.

Increased use would have led to increased demand for fuel. To achieve this, the group(s) that periodically and frequently visited the cave would have probably turned to systematic firewood gathering in the woodlands. There, because of its higher availability, the collection of deadwood and fallen branches would have been easier and more 'cost-effective'. At the same time, whenever the felling of a tree or the cutting of a branch was considered necessary, it would have been easier to choose something of a size appropriate to the type of tools used or the distance back to the cave. Moreover, if the habitation use of the cave was short-term and periodic, we may consider the possibility that part of the firewood was brought in from other nearby areas where the group(s) moved in the course of other seasonal tasks. Throughout, the very local open scrub vegetation would have remained a basic source; the use of the Fabaceae and Labiatae shrubs that could have served as kindling increased during the LN and FN in parallel with a more frequent use of the cave and higher demand then.

The interior chambers: ritualistic use of the vegetation

Locations Θ 9 and Θ 10

Table 19.4 presents the results from these two locations in chamber D, close to the habitation Chamber B. These two niches were excavated during the early years of investigations at Alepotrypa Cave. The finds in them indicate a ritualistic use of the area, as an ossuary. The wood charcoal remains from these two locations are too few for any meaningful quantification. The results indicate that the same taxa were used in both cases, all of them also present in the vegetation sequence of the site as revealed in the results from Trench B1. *Prunus* specimens are the most numerous in both locations, followed by *Phillyrea/Rhamnus alaternus* and Fabaceae, therefore suggesting the use of both open vegetation and evergreen woodland.

Table 19.4. Results of the analysis of wood charcoal samples from locations Θ 10 and Θ 9; absolute numbers of wood charcoal fragments

<i>Taxa</i>	Θ 10	Θ 9
<i>Quercus</i> sp. deciduous type	1	1
<i>Quercus</i> sp.	2	2
<i>Quercus</i> sp. evergreen type	3	1
<i>Phillyrea/Rhamnus alaternus</i>	1	8
<i>Acer</i> sp.	1	
<i>Prunus amygdalus</i>	2	6
<i>Prunus amygdalus/P. spinosa</i>	11	9
cf <i>Prunus</i> sp.	1	
<i>Prunus/Rosa</i>	3	2
Fabaceae	4	1
Labiatae	1	1
angiosperm	5	2
bark		1
nutshell	3	
Total	38	34

Location Θ 14

This location is characterised by human bone scatters and pottery fragments, suggesting again a ritualistic use. It was excavated in 2013. The 50 cm deep stratigraphy revealed a sequence with a layer of dung at the bottom capped by a hearth and overlain by a series of alternating clay surfaces and hearths comprising a distinct depositional unit. The topmost upper surface constitutes a different layer, unrelated to the lower sequence from the Θ 14 location.

Many charcoal samples were recovered from the excavated layers; an effort was made to distinguish between the successive burning episodes and clay surfaces. We have tried to compare the successive hearth-and-dung-layer and hearth-and-floor episodes: the results are shown in Table 19.5 and in Figure 19.4. All the main taxa that characterise the habitation sequence of Alepotrypa are present. The dominant ones are again the woodland taxa, *Phillyrea/Rhamnus alaternus*, evergreen and deciduous *Quercus* and the open and scrub vegetation varieties, *Prunus* and the Fabaceae. The successive episodes show variation in the taxa percentage composition: such is a common characteristic of short-term depositional contexts such as hearths, where the wood charcoal remains represent only the last burning (Badal 1992; Chabal 1997). This is certainly the case at Θ 14, where each hearth most probably was a single episode then covered over and separated from the following by a thin fill of earth. An equal use of firewood from woodland and open/scrub vegetation is documented in the lowermost burning episode; woodland was then the main fuel source in the two successive hearths above it (Figure 19.4); and finally firewood, mostly collected from the open vegetation and scrub, was used in the uppermost hearth and the floor and structure above that. These single burning episodes confirm the observations made from the habitation sequence, namely the use of different vegetation types growing in the vicinity of the site. A distinct characteristic of the hearths is the presence of *Pinus nigra* remains in each one of them, a taxon of extra-local origin. It is possible that the single burning episodes, in addition to the use of different taxa and vegetation types, also reflect the management of the fire itself: scrub vegetation providing kindling for the initial stages and the thicker branches of the tree taxa the fuel once the blaze was established.

In the Θ 14 location, the upper surface is a layer distinct from the ones below it. The results of the wood charcoal analysis from this uppermost layer are presented in Table 19.6 and Figure 19.5 where they are correlated with the underlying sequence, namely the hearth-and-floor complex of layers (treated as the single effective unit it is) and the hearth-and-dung feature at its base. The results from the upper surface are in relative agreement with the LN and FN sections of the habitation sequence which document a more intensive use of the Mediterranean woodland for the procurement of fuel.

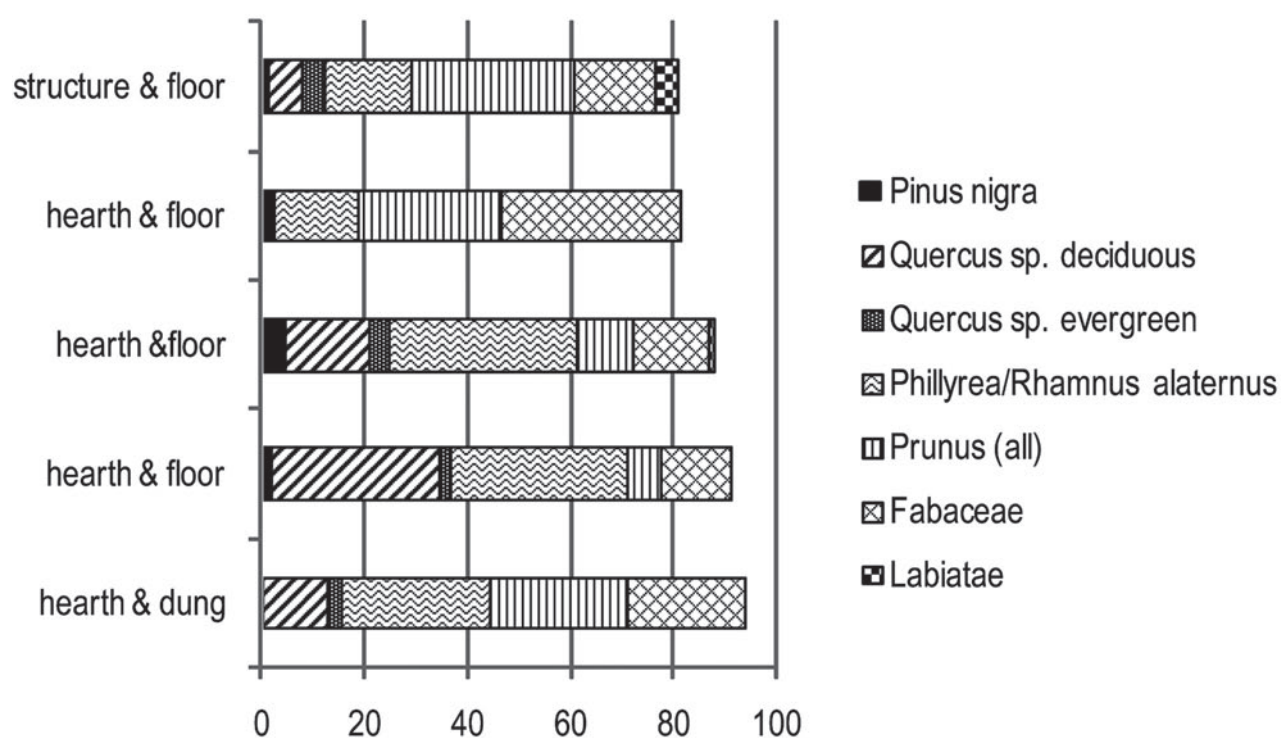


Figure 19.4. Bar-chart showing the relative frequency of taxa in the composition of each burning episode in Θ 14, from bottom to top.

Table 19.5. Results of the analysis of wood charcoal samples from successive hearth-and-dung layer and hearth-and-floor episodes in Θ 14

Θ 14	Hearth & dung		Hearth & floor		Hearth & floor		Grey fill	Hearth & floor		Organic fill	Structure & floor	
units	871, 872		869, 870		866, 867		860	856, 857		855	853, 854	
Taxa	n	%	n	%	n	%	n	n	%	n	n	%
cf <i>Abies</i>												
<i>Pinus nigra</i>			3	1.8	6	4.5		1	2.3		1	1.1
<i>Pinus</i> sp.											1	1.1
<i>Fraxinus</i> sp.												
cf. <i>Fraxinus</i>												
<i>Quercus</i> sp. deciduous type	9	12.8	55	32.9	22	16.4	1				6	6.7
<i>Quercus</i> sp.			7	4.2	6	4.5	1			2	1	1.1
<i>Quercus</i> sp. evergreen type	2	2.8	3	1.8	5	3.7	1			2	4	4.5
<i>Phillyrea/Rhamnus alaternus</i>	20	28.5	58	34.7	49	36.6	6	7	16.3	7	15	16.9
<i>Ficus carica</i>			1	0.6								
<i>Acer</i> sp.			3	1.8								
<i>Pistacia lentiscus</i>					1	0.7		1	2.3			
<i>Pistacia terebinthus/P. atlantica</i>					1	0.7						
<i>Pistacia</i> sp.			1	0.6						1		
<i>Prunus amygdalus/P. spinosa</i>	10	14.2	6	3.6	3	2.2		9	20.9	4	17	19.1
<i>Prunus amygdalus/P. webbii</i>	9	12.8	5	3.0	12	9.0		3	7.0	7	11	12.4
<i>Juniperus</i> sp.												
Fabaceae	16	22.8	22	13.2	19	14.2	7	15	34.9	9	14	15.7
Labiatae					2	1.5					4	4.5
cf. Labiatae												
cf. <i>Cistus</i>	1	1.4									1	1.1
cf. <i>Erica</i> sp.			1	0.6								
nutshell							2	1	2.3		2	2.2
bark	1	1.4	1	0.6	1	0.7					1	1.1
angiosperm	2	2.8	1	0.6	7	5.2	2	6	14.0	1	11	12.4
Total	70	100	167	100	134	100	20	43	100	33	89	100

(n = number of wood charcoal fragments, % = percentage fragment count for each taxon).

Table 19.6. Results of the analysis of wood charcoal samples from successive distinct layers in the sequence of Θ 14; comparison between the upper surface with the complex hearth layer and the hearth-and-dung basal layer

Θ 14	Hearth-dung		Hearth-floor complex		Upper surface	
Unit	871, 872		855, 856, 857, 860, 866, 867, 869, 870		850, 852	
Taxa	n	%	n	%	n	%
cf. <i>Abies</i>					1	0.5
<i>Pinus nigra</i>			11	2.3		
<i>Pinus</i> sp.			1	0.2		
<i>Fraxinus</i> sp.					2	1.0
cf. <i>Fraxinus</i>					1	0.5
<i>Quercus</i> sp. deciduous type	9	12.9	84	17.3	24	11.9
<i>Quercus</i> sp.			17	3.5	4	2.0
<i>Quercus</i> sp. evergreen type	2	2.9	15	3.1	41	20.3
<i>Phillyrea/Rhamnus alaternus</i>	20	28.6	142	29.2	93	46.0
<i>Ficus carica</i>			1	0.2		
<i>Acer</i> sp.			3	0.6		
<i>Pistacia lentiscus</i>			2	0.4		
<i>Pistacia terebinthus/P. atlantica</i>			1	0.2		
<i>Pistacia</i> sp.			2	0.4		
<i>Prunus amygdalus/P. spinosa</i>	10	14.3	41	8.4	4	2.0
<i>Prunus amygdalus/P. webbii</i>	9	12.9	38	7.8	10	5.0
<i>Juniperus</i> sp.					1	0.5
Fabaceae	16	22.9	86	17.7	20	9.9
Labiatae			6	1.2		
cf. Labiatae					1	0.5
cf. <i>Cistus</i>	1	1.4	1	0.2		
cf. <i>Erica</i> sp.			1	0.2		
nutshell			5	1.0		
bark	1	1.4	3	0.6		
angiosperm	2	2.9	26	5.4		
Total	70	100	486	100	202	100

(n = number of wood charcoal fragments, % = percentage fragment count for each taxon).

In the two underlying layers, a more balanced use of the woodland and the open vegetation is observed. A difference between the hearth-and-floor unit from the others is the presence of *Pinus nigra* in it.

In general, the taxa percentage composition of the Θ 14 location, either taken as a whole or when divided into different layers, shows a greater correspondence with the habitation sequence of Trench B1 than with the interior chambers (see below). A link between the latter and the hearth-and-floor layer of Θ 14 is the constant presence of *Pinus nigra* (see below).

Locations Z22 and Z24 in Chamber Z and LA1 and LAN in the Chamber of Lakes

The ritualistic use of Chamber Z and the Chamber of Lakes is suggested by both their locations and by their finds. The wood charcoal analysis results for locations Z22 and Z24 are presented in Table 19.7. Two sets of data are included for Z22, the first one deriving from the analysis of wood charcoal material collected in 2014 and dated to the late EN and the second from material recovered during the early excavations.

Wood charcoal samples were recovered during the early excavations from the Chamber of Lakes and in particular from locations LA1 (very close to the passage from Chamber Z to the area of the lakes) and LAN. The results of the wood charcoal analysis of these samples are presented in Table 19.8.

In the samples from Chamber Z and the Chamber of Lakes, the predominance of *Phillyrea/Rhamnus alaternus* (>30% and up to 75 in Z22 EN) and Fabaceae (in general >30%) is documented alongside the abundant presence of other shrub vegetation such as the Labiatae and *Cistus* (Figure 19.6). All the other taxa identified are the same as those found in the habitation sequence except for *Pinus nigra*, the presence of which is confined to the interior chambers and locations. The percentage values of *Quercus*, both evergreen and deciduous, and *Prunus* are very low, as is also the case with the other identified taxa, namely *Pistacia lentiscus* and Maloideae.

To the similarities in the composition of the samples from the two chambers we should add the high frequency of fragments with strong curvature. In the samples from the Chamber of Lakes, there were various fragments preserving

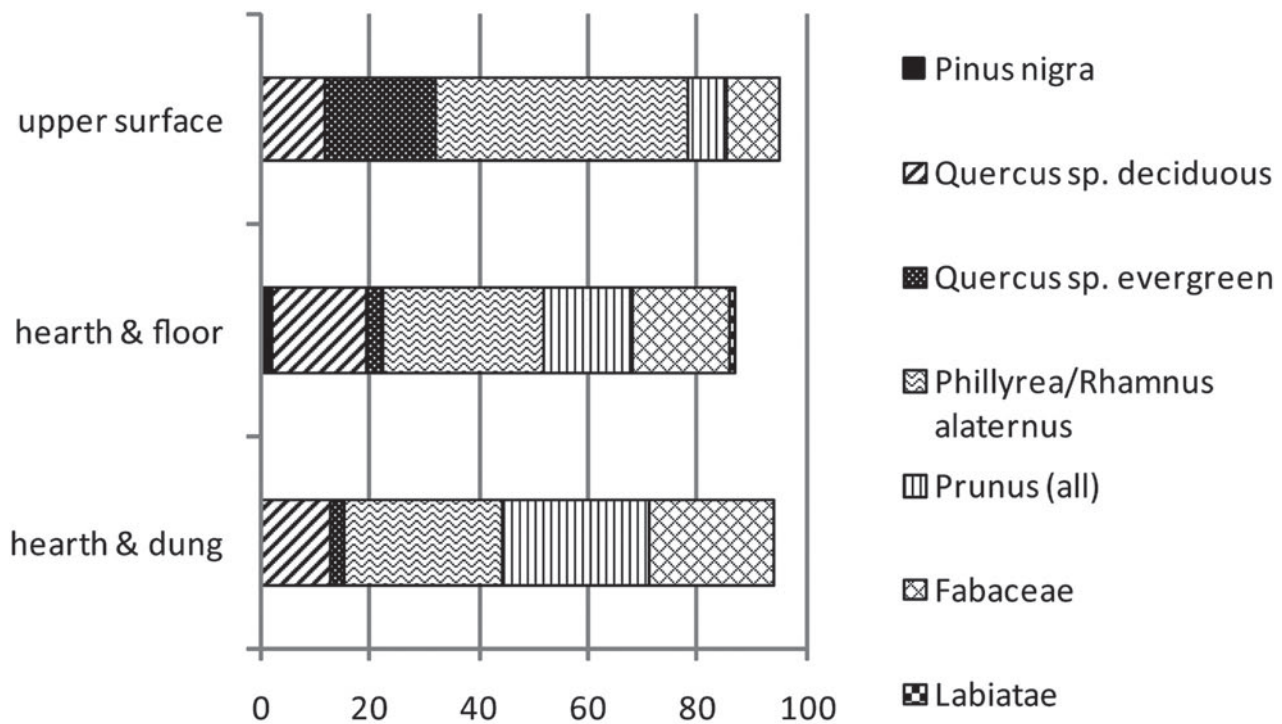


Figure 19.5. Bar-chart showing the relative frequency of taxa in the composition of the upper surface in comparison with the hearth-and-floor complex and the basal hearth-and-dung layer in Θ 14.

Table 19.7. Results of the analysis of wood charcoal samples from different locations and/or cultural phases of the interior Chamber Z

Taxa	Z22 late EN		Z22		Z24	
	n	%	n	%	n	%
<i>Pinus nigra</i>			3	1.8		
<i>Quercus</i> sp. deciduous type	1	1.5	4	2.4	1	0.9
<i>Quercus</i> sp. evergreen type	1	1.5	2	1.2		
<i>Phillyrea/Rhamnus alaternus</i>	51	75.0	53	31.7	26	22.4
<i>Pistacia lentiscus</i>			2	1.2		
cf. <i>Maloideae</i>	1	1.5				
<i>Prunus amygdalus/P. webbii</i>	3	4.4			1	0.9
<i>Prunus amygdalus/P. spinosa</i>			1	0.6		
Fabaceae	5	7.4	73	43.7	45	38.8
Labiatae	1	1.5	18	10.8	13	11.2
<i>Cistus</i> sp.			4	2.4	20	17.2
angiosperm	4	5.9	7	4.2	10	8.6
bark	1	1.5				
Total	68	100	167	100	116	100

(n = number of wood charcoal fragments, % = percentage fragment count for each taxon).

the pith and the bark, thus allowing for an estimation of their diameter. In Table 19.9 the measurements of the diameter of different taxa are presented and in all cases they indicate the use of twigs with diameters mostly ranging between 4 to 10 mm. In many other fragments both from Chamber Z and the Chamber of Lakes, although

Table 19.8. Results of the analysis of wood charcoal samples from different locations of the interior Chamber of Lakes

Taxa	LA1		LAN		LA twigs
	n	%	N	%	
<i>Pinus nigra</i>	1	0.6	2	2.0	
<i>Quercus</i> sp. deciduous type	2	1.3			
<i>Quercus</i> sp.	2	1.3			
<i>Quercus</i> sp. evergreen type	7	4.4	2	2.0	*
<i>Phillyrea/Rhamnus alaternus</i>	56	35.0	42	42.4	*
<i>Pistacia lentiscus</i>	1	0.6			
cf. <i>Maloideae</i>	1	0.6	1	1.0	*
<i>Prunus amygdalus/P. webbii</i>	1	0.6			*
<i>Prunus</i> sp.			1	1.0	
Fabaceae	48	30.0	42	42.4	*
<i>Cistus</i> sp.	9	5.6	4	4.0	*
Labiatae	28	17.5	4	4.0	*
angiosperm	4	2.5	1	1.0	
Total	160	100	99	100	

(n = number of wood charcoal fragments, % = percentage fragment count for each taxon).

neither an entire radius nor diameter allowing a precise measurement were preserved, a very strong curvature was yet observed, which also points to the presence of twigs. The abundance of fragments with strong curvature for each one of the taxa that preserved these characteristics, namely Fabaceae, Labiatae, *Cistus* and *Phillyrea/Rhamnus alaternus*, is shown in Figure 19.7. The high frequency of specimens with very strong curvature (Figure 19.7), accounting for more than 50% for each taxon in each

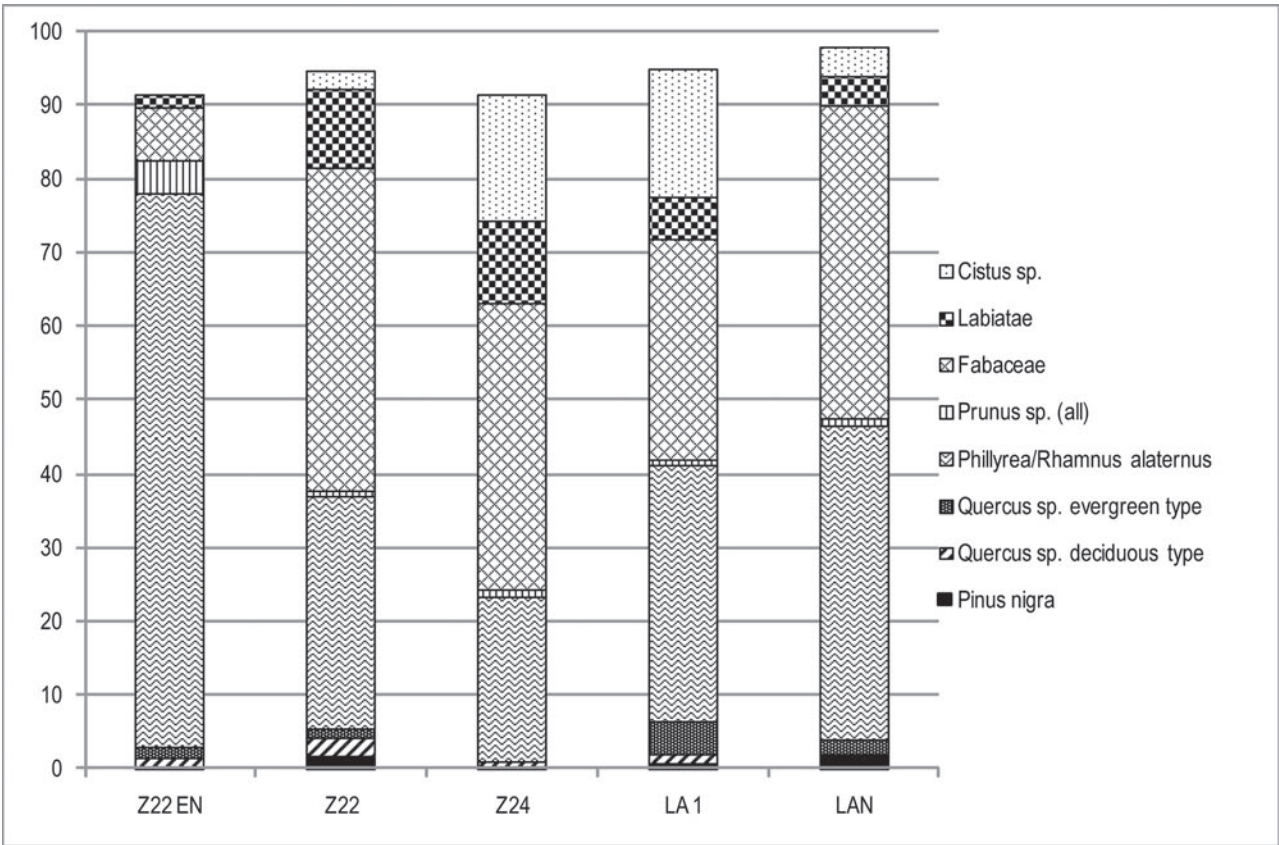


Figure 19.6. Graphic representation of the percentage contribution of each taxon in the composition of the assemblages of different locations in the interior Chamber Z and Chamber of Lakes.

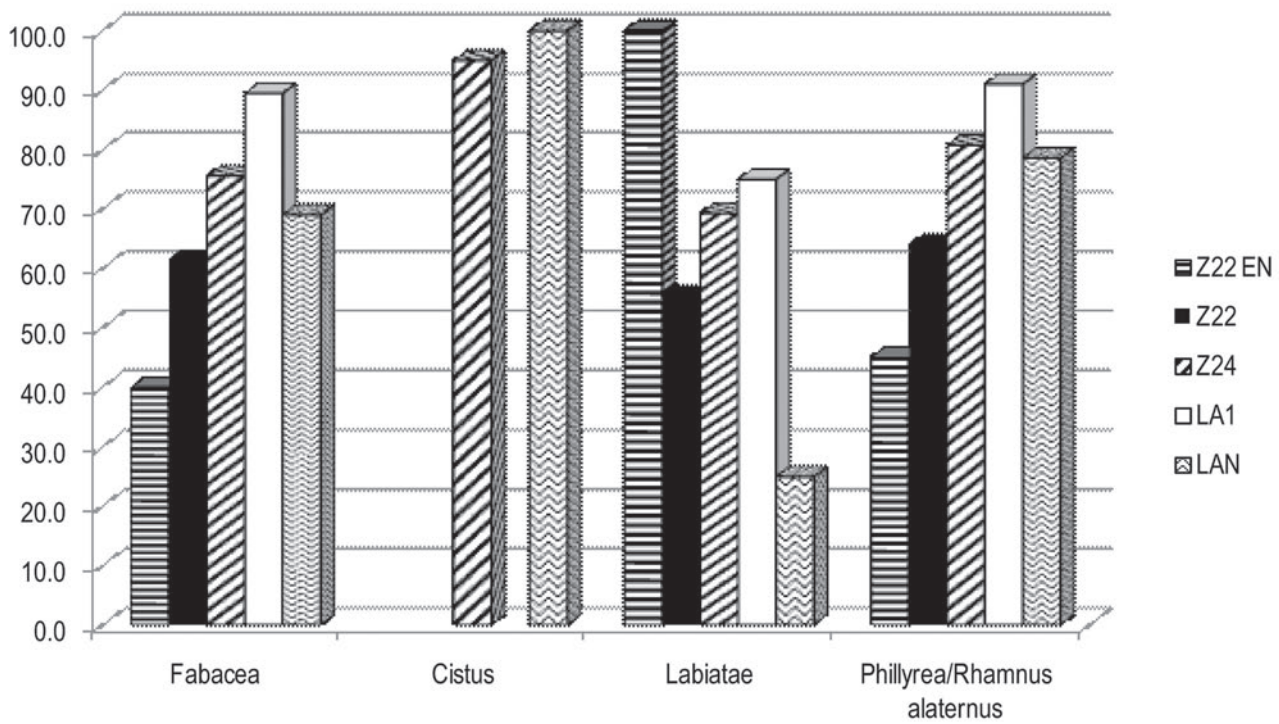


Figure 19.7. Frequency of fragments with strong curvature for the most abundant taxa in the interior chambers. Percentages are based on the count of fragments with strong curvature from the total number of fragments per taxon.

Table 19.9. Diameter measurements in mm of wood charcoal fragments that preserved the pith and bark

<i>Phillyrea/ Rhamnus alaternus</i>	Fabaceae	Labiatae	<i>Cistus</i> sp.	<i>Prunus</i> sp.	Deciduous <i>Quercus</i> sp.	Evergreen <i>Quercus</i> sp.
2.0	4.2	7.3	3.7	12.0	1.6	3.4
2.5	4.8	7.8	4.0	18.8		
3.2	4.8	8.5	4.5			
4.0	5.0	9.3	5.1			
4.3	5.3	10.5	5.6			
5.5	5.4	11.2	6.3			
5.6	6.3	18.3	6.6			
6.1	7.0	25.0	8.5			
6.2	7.2					
6.4	10.4					
6.7	10.9					
6.8	10.9					
7.0	11.3					
7.0	17.6					
7.1	39.8					
7.2						
7.5						
8.7						
8.9						
9.0						
9.2						
10.2						
11.2						
12.3						

one of the different locations, is clearly observable. This pattern suggests the use of twigs in the burning rituals in Chamber Z and the Chamber of Lakes throughout their entire use.

The similarities between Chamber Z and the Chamber of Lakes are striking and might point to similar rituals taking place in these areas. A characteristic observed in the components of samples from the Chamber of Lakes is their rounded forms (Figure 19.8), especially in the LAN samples. Given that the passage from Chamber Z to the area of the lakes is extremely steeply sloped, it is possible that natural or anthropogenic agents caused a gradual displacement of the sediments. This would mean that the LA1 and LAN materials are actually in part derived from soils originating in the Chamber Z deposits.

Discussion and conclusions

Wood charcoal analysis is a useful tool for investigating the composition of and changes in the local vegetation catchments, especially in areas where, as in the case of the Mani Peninsula, other palaeovegetation indicators such as pollen are missing. The closest locale to the cave which boasts paleovegetation data is the eastern Peloponnese: the area of the Argolid, from which the pollen records of Kiladha (Bottema 1990), Lake Lerna (Jahns 1993), Kleonai (Atherden *et al.* 1993) and Lake Thermisia (Sheehan 1979, cited in Bottema 1990 and Jahns 1993) are available. The taxa identified in the wood charcoal

material from Alepotrypa Cave are all present in the zones of these pollen records documenting the Neolithic period, except for *Prunus*, which is an insect-pollinated taxon and therefore hardly ever represented in pollen. Interestingly, for the Neolithic period all the pollen records show the existence of open deciduous oak woodland extending both close to the coastal plains and at higher elevation. From the LN onwards some decrease in the extent of deciduous woodland is documented and during the Bronze Age it is partly replaced by evergreen maquis, an event related to the expansion of cultivated crops and the olive.

At Alepotrypa, the sequence starts with the Neolithic. Thus there is no earlier evidence for the composition and characteristics of the vegetation. For the time interval between c. 6,000 and 3,200 cal BC, the results from Alepotrypa Cave indicate that deciduous oak and evergreen or mixed woodland extended even to the southernmost parts of the Peloponnese. This would have been the normal vegetation of the area until at least the end of that period. Open scrub vegetation was also characteristic of the region: it was probably confined to the steeper and stonier ground, but in the course of the Neolithic might have also expanded onto cleared land.

In agreement with the pollen record from the Argolid (Jahns 1993), as well as from other Neolithic Greek sites (Ntinou 2011; Ntinou and Stratouli 2012; Badal and Ntinou 2013), the presence of *Olea* is very scarce at Alepotrypa. In most Neolithic sites of southern Greece only a few fragments of the taxon appear in FN or Chalcolithic



Figure 19.8. Typical wood charcoal fragments in LAN location. Note the rounded forms (photo by P. Karkanas).

assemblages. Therefore, this tree that at present is the indicator and the most abundant representative of the vegetation of the thermo-mediterranean zone was not a distinctive characteristic of the Neolithic landscapes of the coastal southern Peloponnese until later in the Bronze Age, when its numbers probably increased due to cultivation (Jahns 1993; Bottema 1990). Until then, it could have been growing at a modest level in the deciduous oak woodland (Bottema 1990) or in riparian habitats along ephemeral streams, as is suggested by wood charcoal data from Neolithic sites in western Europe (Terral *et al.* 2004), thus making a negligible contribution to firewood gathering.

The results from the habitation sequence of the cave indicate the diversity of vegetation types and taxa in the local environment and the increased and possibly more systematic management of the woodland through time in response to a greater and growing demand for firewood. In the interior chambers of Alepotrypa Cave, where ritualistic usage is suggested, certain taxa are more abundant or specific to these locations, while the use of small-calibre wood is documented in several instances. To these findings we should add the information yielded by micromorphology (Karkanas, this volume) and phytolith finds (Tsartsidou, this volume), which both indicate a constant presence of dung in the interior locations Θ 14, Z22, Z24 and LA 1. Was there a deliberate selection of fuels related to the ritualistic uses of the cave?

To this end, the points to discuss are the presence of twigs and dung in the interior locations. Several taxa are mainly represented by very small-calibre wood in Chamber Z and the Chamber of Lakes. Similarly, the presence of transverse planes of twigs (*Phillyrea* and other angiosperms) of a few millimetres diameter was observed in the micromorphology sections from Chamber Z (A117) (Karkanas, this volume). Moreover,

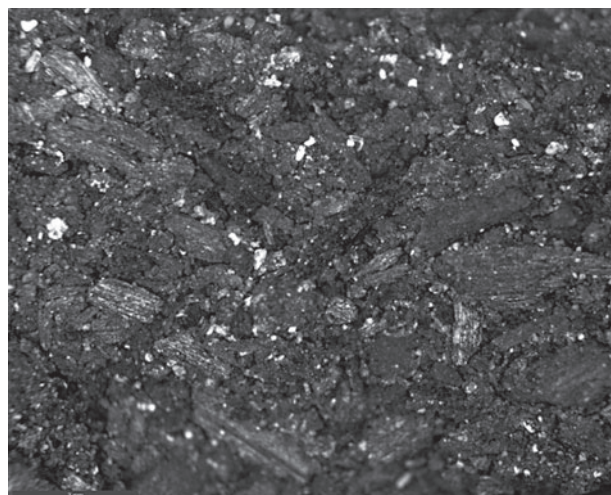


Figure 19.9. Consolidated pieces of the thick charred matter observed in location Z22. Small (<2 mm) pieces of wood charcoal embedded in the black matrix, with some sand-sized particles (photo by P. Karkanas)

in the samples of Chamber Z, two other observations of relevance were made. In many samples the form of the wood charcoal was that of thin flakes that could have resulted from the crushing of bigger fragments, but which still preserved their anatomical structure. There were also pieces of sediment that preserved abundant charcoal flecks in a conglomerate mix, forming dense organic charred matter (Figure 19.9). These macroscopic observations are in agreement with the micromorphology finds from location Z22, where ‘macerated’ woody tissue of different taxa can be recognised mixed with dung *in situ* layers (Karkanas, this volume). Therefore, the dense organic matter observed in the interior chambers could be a mixture of dung and the woody twig remains of leaf fodder, soaked and broken up into very small pieces as a result of trampling and animal penning conditions. Taken together, such characteristics would indicate the presence of manure deposits, excrement of domestic animals mixed with feed and/or bedding materials (Kühn *et al.* 2013). These findings at other cave sites would suggest animal penning at the spot where the remains of the leafy fodder were recovered. However, at Alepotrypa, Chamber Z and the Chamber of Lakes would have been difficult to reach and highly inadequate for animal rearing. They are located at least 80 m into the cave from the present-day entrance; before the 1950s interventions the only way in and out was by means of a small down-sloping access, passable only on one’s knees. Moreover, the topographic features of the area (the presence of lakes) and all other finds in the area, *i.e.*, fragmented fine pottery ware (Psimogiannou this volume), secondary burials (Papathanasiou this volume) and unused lithics (Kourtessi-Philippakis this volume) all imply a non-domestic, ritualistic usage where fire was required. Therefore, composted dung, including the remains of fodder/bedding material, was apparently

brought in and used deliberately for fuel in the rituals, which took place in the interior of the cave.

According to the available evidence, dung was used as a basal layer probably to enhance and keep alight the fire set on it at location Θ 14, while at Z22, Z24, LA 1 and LAN, the use of dung together with twigs of woody taxa is suggested. The results from location Θ 14 demonstrate variable use of woody taxa in successive burning episodes, while in Z22, Z24, LA1 and LAN, apart from the presence of small-calibre wood, there is repeated use of the same plant taxa. Both the faunal (Hadjikoumis, this volume) and phytolith (Tsartsidou, this volume) data suggest that the Neolithic inhabitants of the cave kept livestock mainly composed of sheep. Ethnographic observations indicate that dung from sheep and goat, in pellet form, is more compact than cow dung, and that after it has accumulated in the stall over the winter it becomes even denser, thus making it a better fuel (Miller 2010). Such a material would have been an excellent, slow-burning fuel capable of being set alight using kindling of small-calibre woods. In the innermost chamber of the cave, it is possible that the preference for dung, as well as the selection of small-calibre wood and certain woody taxa for the fuels, was dictated more by the difficulty of access (and so the imposition of a limit on the size of material able to be brought in) rather than the demands of any specific ritual. In Chamber Z and the Chamber of Lakes, shrubs that provide abundant twigs were used for the most part, as well as *Phillyrea/Rhamnus alaternus* twigs. These would have been easy to carry and drag inside the cave; the surrounding scrub vegetation (Fabaceae, Labiatae, Cistus) would have provided plenty of it. Moreover, twigs from the *Phillyrea* leafy fodder could have been recovered from the animal pens along with their dung, for the purposes of burning. Twigs would have worked as the kindling to light the manure, while a few bigger logs of oak or other trees could have been occasionally added to maintain a low fire. These last are indeed present in low numbers in the wood charcoal samples. However, the bulk of the firewood consumed would have been smaller branches and twigs.

The use of dung and small branches and twigs as firewood in the interior chambers was probably imposed by the topography and difficulty in accessing these areas, as argued above. Nevertheless, within a ritualistic context we should not downplay the evocative atmosphere that would have been created by the slow-burning glow of dung and the crackling sound of scrub wood thrown onto the fire. To this portrait of the usage of the interior locations we should add another common element: the presence of *Pinus nigra*. The taxon would not have been found in the local vegetation around Alepotrypa. At present it is the primary woodland species of the Taygetos mountains. Although in the past it could have extended towards the lowlands, that from Alepotrypa must have been brought from quite some distance. Apropos to the

rare presence of the black pine (and some fir) we may suggest the use of conifers in the interior of the cave for lighting, since the resin of their wood makes them appropriate for torches. The use of conifer wood (pine, fir and spruce) for such purposes has been recorded in mining activities of the Halstaat culture (Forbes 1966, 214; Barker 1999, 111; Grabner *et al.* 2010). Bundles of pine torchwood would have lit the way up to the interior chambers, would have ignited the fuel and would have illuminated the return to the exit. The presence of black pine perhaps also indicates the origin, movement or contacts of the group(s) or certain individuals with more distant areas, probably for specific tasks.

The study of wood charcoal remains from Alepotrypa Cave, in agreement with the analysis of other categories of material culture, supports the idea of its differentiated use: habitation/domestic in Chamber B, which is closer to the entrance/exit, and ritualistic in the interior chambers. From the late EN to the FN, the group(s) that used the cave as a habitation space collected firewood from the local environment. Open vegetation growing on the rocky slopes was systematically used, while Neolithic activities gradually expanded to take in the evergreen woodland and deciduous thickets through time, probably as a response to higher demand. The rituals in the interior of the cave involved the use of fire, where the main fuels were dung and twigs of Fabaceae, Labiatae, *Cistus* and *Phillyrea/Rhamnus alaternus*. The use of these fuel types, lighter and easier-to-carry than bigger wood logs, was dictated by the difficult access to the interior chambers. The selection of an impressive setting such as the interior chambers for the performance of rituals was a purposeful act in all respects, from the elusive character of the ‘ceremonies’, of which mainly pottery and bone scatters remain, to the selection of specific fuel types and black pine torchwood brought from quite a distance.

Bibliography

- Asouti, E. and Austin, P. (2005) Reconstructing woodland vegetation and its exploitation by past societies, based on the analysis and interpretation of wood charcoal macro-remains. *Environmental Archaeology* 10, 1–18.
- Atherden, M., Hall, J. and Wright, J. C. (1993) A pollen diagram from the northeast Peloponnese, Greece: implications for vegetation history and archaeology. *The Holocene* 3, 351–356.
- Badal, E. (1992) L’anthracologie préhistorique: à propos de certains problèmes méthodologiques. In J. L. Vernet (ed.) *Les charbons de bois, les anciens écosystèmes et le rôle de l’homme: Colloque organisé à Montpellier du 10 au 13 septembre 1991*, 167–189. (Bulletin de la société botanique de France, Actualités Botaniques 139). Paris.
- Badal, E. and Ntinou, M. (2013) Wood-charcoal analysis: the local vegetation. In N. Efstratiou, A. Karetsoy and M. Ntinou (eds) *The Neolithic Settlement of Knossos in Crete: New Evidence for the Early Occupation of Crete and the Aegean Islands*, 95–118. (INSTAP Monograph Series 42). Philadelphia.

- Barbero, M. and Quézel, P. (1976) Les groupements forestiers de Grèce centro-meridionale. *Ecologia Mediterranea* 2, 3–86.
- Barker, G. (ed.) (1999) *Companion Encyclopedia of Archaeology*. London and New York.
- Bohn, U. and Neuhäusl, R., with contributions by Gollub, G., Hettwer, C., Neuhäuslova, Z., Raus, Th., Schlüter, H. and Weber, H. (2000/2003) *Map of the Natural Vegetation of Europe, Scale 1:2.500.000*. Münster.
- Bottema, S. (1990) Holocene environment of the Southern Argolid: a pollen core from Kiladha Bay. In T. J. Wilkinson and S. T. Duhon (eds) *Franchthi Paralia. The Sediments, Stratigraphy and Offshore Investigations*, 117–138. (Excavations at Franchthi Cave 6). Bloomington.
- Chabal, L. (1997) *Forêts et sociétés en Languedoc (Néolithique final, Antiquité tardive). L'anthracologie, méthode et paléoécologie*. (Documents d'Archéologie Française 63). Paris.
- Chabal, L., Fabre, L., Terral, J-F. and Théry-Parisot, I. (1999) L'Anthracologie. In C. Bourquin-Mignot, J.-É. Brochier, L. Chabal, S. Crozat, L. Fabre, F. Guibal, P. Marinval, H. Richard, J.-F. Terral and I. Rhéry, *La Botanique*, 43–104. Paris.
- Crivellaro, A. and Schweingruber, F.H. (2013) *Atlas of Wood, Bark and Pith Anatomy of Eastern Mediterranean Trees and Shrubs: with a Special Focus on Cyprus*. Wallingford and Boston.
- Dafis, S. (2010) *The Forests of Greece*. Athens.
- Forbes, R. J. (1966) *Studies in Ancient Technology* VII. Leiden Netherlands.
- Grabner, M., Klein, A., Reschreiter, H. and Barth, F-E. (2010) Wood supply of the Bronze Age salt mining site at Hallstatt, Austria. In P. Anreiter et al. (eds) *Mining in European History and its Impact on Environment and Human Societies – Proceedings for the 1st Mining in European History – Conference of the SFB-HIMAT, 12–15, November 2009, Innsbruck*, 171–176. Innsbruck.
- Jahns, S. (1993) On the holocene vegetation history of the Argive Plain (Peloponnese, southern Greece). *Vegetation History and Archaeobotany*, 2, 187–203.
- Kühn, M., Maier, U., Herbig, C., Ismail-Meyer, K., Le Bailly, M. and Wick, L. (2013) Methods for the examination of cattle, sheep and goat dung in prehistoric wetland settlements with examples of the sites Alleshausen-Taschenwiesen and Alleshausen-Grundwiesen (around cal 2900 BC) at Lake Federsee, south-west Germany. *Journal of Environmental Archaeology*, 18, 43–57.
- Marguerie, D. and Hunot, J.-Y. (2007). Charcoal analysis and dendrology: data from archaeological sites in north-western France. *Journal of Archaeological Science* 34, 1417–1433.
- Miller, N. F. (2010) *Botanical Aspects of Environment and Economy at Gordion, Turkey*. (Gordion Special Studies 5, Museum Monograph 131). Philadelphia.
- Ntinou, M. (2011) Charcoal analysis at the Cave of the Cyclops, Youra, Northern Sporades. In A. Sampson (ed.) *The Cave of the Cyclops: Mesolithic and Neolithic Networks in the Northern Aegean Greece. II: Bone Tool Industries, Dietary Resources and the Paleoenvironment, and Archeometrical Studies*, 297–314. (Prehistory Monograph 31). Philadelphia.
- Ntinou, M. and Stratouli, G. (2012) Charcoal analysis at Drakaina Cave, Kephallonia, Ionian islands, Greece. A case study of a specialized Late Neolithic and Chalcolithic site. In E. Badal, Y. Carrion, M. Macias and M. Ntinou (coords). *Wood and Charcoal. Evidence for Human and Natural History*, 43–52. (Saguntum Papeles del Laboratorio de Arqueologia de Valencia, Extra 13). Valencia.
- Polunin, O. (1980) *Flowers of Greece and the Balkans: A Field Guide*. Oxford.
- Quézel, P. and Barbero, M. (1985) *Carte de la végétation potentielle de la région méditerranéenne. I: Méditerranée orientale*. Paris.
- Rackham, O. (1990) Observations on the historical ecology of Santorini. In D. A. Hardy (ed.) *Thera and the Aegean World III. Proceedings of the Third International Congress, Santorini, Greece, 3–9 September 1989*, 2, 384–391. London.
- Sadori, L., Jahns, S., Peyron, O. (2011) Mid-Holocene vegetation history of the central Mediterranean. *The Holocene* 21, 117–129.
- Schweingruber, F. H. (1990) *Anatomie Europäischer Hölzer*. Bern and Stuttgart.
- Sheehan, M.C. (1979) *The Postglacial Vegetational History of the Argolid Peninsula, Greece*. Unpublished PhD Thesis, University of Indiana.
- Terral, J.-F., Badal, E., Heinz, C., Roiron, P., Thiebault, S. and Figueiral I. (2004) A hydraulic conductivity model points to post-Neogene survival of the Mediterranean olive. *Ecology* 85, 3158–3165.
- Turland, N. J., Chilton, L. and Press, J. R. (1993) *Flora of the Cretan Area*. London.

The microfauna from Alepotrypa Cave

Katerina Papayianni and Thomas Cucchi

Introduction

Alepotrypa Cave is considered an important Neolithic site in Greece in general and the Peloponnese in particular, because its deposits, which cover a long time span, were sealed by a geological episode and thus remained undisturbed in later periods (Karkanas, this volume). For this reason, the excavation has provided valuable information concerning the society and economy of the inhabitants of the cave and, perhaps, its immediate vicinity, primarily through analysis of the rich osteoarchaeological material buried in the cave and the associated cultural remains. The later campaigns have also yielded bioarchaeological data, which will assist in the reconstruction of the palaeoenvironment and subsistence strategies of the cave's inhabitants.

A microfaunal analysis of material from Alepotrypa is also of interest for the palaeoenvironmental reconstruction of the microcosm of the cave, as well as of the vegetation that existed in the immediate vicinity, as it could have been a reflection of the local microvertebrate population (Vigne 1996; Vigne and Bailon 2002). Furthermore, it is of interest to identify the presence, or absence, of the house mouse (*Mus musculus*) within stored foodstuffs, since there is evidence for crop or other food/liquid storage in Alepotrypa (large vessels, pits). Finally, periods of abandonment of the cave could be indirectly highlighted by the microfauna analysis and the study of its taphonomic history. Evidence for avian or mammalian predation, if found, would be such an indicator: predators usually find deserted or empty areas to digest their prey. Furthermore, the discovery of abundant chiropteran bones can also indicate an abandonment phase, because bats prefer quiet areas to establish their colonies and so avoid places of intense human use.

Research limitations

One major obstacle for the retrieval of microvertebrate remains existed: the Alepotrypa excavations began in

the 1970s and lasted through the 1990s, at a time when soil sampling for archaeobotanical or other remains was not common practice in the Greek Archaeological Service. Furthermore, during all these years when different campaigns were conducted in the cave different methodologies of soil/bone retrieval were at times adopted. Of note is the fact that a certain area of the cave was dug by a French team, led by Dr Catherine Perlès, during the 1971 campaign, when soil flotation was not a systematic retrieval procedure. The French team, however, screened and sorted soil samples, out of which rodent bones have been identified; in other parts of the cave this system was not then employed.¹ George Papathanassopoulos, director of the Alepotrypa excavations, commenced soil sampling during the later field seasons (*i.e.*, from 1988 onwards), from which microvertebrate bones were also retrieved. Accordingly chances to sample deposits from vessels or man-made structures, like hearths or pits, excavated earlier, as in Chamber B, were missed. If sampled, they would surely have yielded valuable information about the microfauna. The last two campaigns of the 2011 and 2013 seasons have produced most of the microfauna material under study. Despite the uneven retrieval history, a total of 47 samples containing microfauna from the Alepotrypa deposits have been studied: the results are presented here.

Materials and methods

The material was processed at the Ephorate of Palaeoanthropology-Speleology, as well as at the Wiener Laboratory of the American School of Classical Studies at Athens, and a Leica EZ4D stereomicroscope with fitted digital camera was used. Cranial bones were separated from post-cranial; all were recorded according to their anatomical element, degree of breakage and taxon; the cranial bones were recorded per taxon, family and genus/species, where possible. Micromammal identification per

family and genus is based on cranial characters, and more specifically on the morphometry of molars and premolars (Hillson 1995). The dimensions of the occlusal surface of different teeth per species allow identification to species level. The *Apodemus* occlusal morphometry and the relevant measurements follow Van de Weerd (1976). The *Mus* sp. identification was based on a Geometric Morphometrics molar shape analysis after Cucchi *et al.* (2011). Reptile vertebrae have been identified according to Szyndler (1991).

Results – systematics

The samples under examination came from the 1971, 1980, 1988, 1992, 1993, 1996, 2001, 2011 and 2013 campaigns. Four samples from trenches A3-4-5 of the anterior part of the cave are dated to the Early Neolithic and contain exclusively amphibian bones; eight samples date to the transition from the Late Early to Middle Neolithic stratigraphical horizons (radiocarbon dated at between 6,220–6,030 cal BC; OxA-29203, 7246 ± 36 and 6,010–5,880 cal BC; OxA-29208, $7,071 \pm 36$ BP), coming from trenches A5-6 and B1 in the anterior part of the cave; one sample was dated at 5,400–4,300 cal BC and it also comes from Trench B1; 17 are dated to the Late/Final Neolithic and they come from trenches Z22a and Θ 9–10 in the interior part of the cave, as well as from Trench B1 in the anterior part; 34 samples are dated to the Final Neolithic (4,240–3,800 and 3,370–3,100 cal BC; X-2468-33 and OxA-29067) from trenches B1a, B2-3-5 in the anterior part of the cave and LAI, Θ 14 in the interior part.

A single sample is of general Neolithic date, recorded as from the ‘ditch’ (τάρπος) and to be identified with Trench B1. Two samples come from the interior Chamber of Lakes and date to the Final Neolithic; two more are from surface layers (for the C14 dates, see Papathanasiou, this volume). Finally, five samples from trench Z22a belong to a comingled layer with dates covering the Early to the Final Neolithic.

The Alepotrypa material contains mice of the Murinae subfamily, voles of the Arvicolinae subfamily, snakes of the Colubrinae subfamily, toads and frogs of the Bufonidae and Ranidae families and very few bird bones (Tables 20.1–4). The *Number of Identified Specimens* (NISP) with relative chronologies for micromammals are given in Table 20.1, for amphibian and reptile bones in Tables 20.2 and 3 and for bird bones in Table 20.4. In terms of NISP, out of a total of 557 specimens, ninety-nine (99) belong to amphibians, fifty-seven (57) belong to reptiles, six (6) to birds and the rest to micromammals. Table 20.5 contains micromammal cranial bones and dentitions per species and chronological phase. Measurements of complete micromammal molars are given in Table 20.6.

Order Chiroptera

Family Vespertilionidae

A right mandible of a bat was recovered from a comingled layer, comprising material from the Early to the Final Neolithic at Niche Z22a. It probably belongs to a mouse-eared bat, cf. *Myotis* sp., but the lingual cusps of the molars were too broken to facilitate the identification. Furthermore, it cannot be securely dated. There is also a bat humerus from an unknown context (see below). Since they are the only chiropteran skeletal evidence in the cave, they might be intrusive.

Order Rodentia

Family: Muridae; Subfamily: Murinae (mice)

RATTUS SP.

A left mandible of an old *Rattus* sp. was recovered from the Final Neolithic horizon of Trench B1a (molar measurements in Table 20.6). It was not accompanied by postcranial bones. The genus *Rattus* spread into the Mediterranean during the Roman conquest, so the molar cannot be dated to the Neolithic period (Reumer 1986). Furthermore, it betrayed evidence of predator digestion, which confirms it as intrusive.

APODEMUS SP. (ROCK MOUSE, YELLOW-NECKED MOUSE OR WOOD MOUSE)

A total number of 34 upper and lower molars, either isolated or in their jaws, have been attributed to the genus *Apodemus* (Table 20.5). They are all dated to the Late/Final Neolithic phase. The measurements of the occlusal surface of the molars are given in Table 20.6. The identification of the species was based on scatter diagrams of the occlusal dimensions: archaeological upper or lower first molar length versus width, and compared with modern reference samples (CPII 42 and 43). Six sibling species of this genus are sympatric in mainland and island Greece nowadays (Kapantaidakis *et al.* 2010); differentiation among them in dental terms has not yet proved possible. The Alepotrypa material contains two sibling species of this genus, possibly *A. mystacinus* and *A. flavicollis* or *A. sylvaticus*. Modern samples of the remaining sibling species were not available for comparison.

MUS SP.

Six mandibles and five maxillae attributed to *Mus* sp. were recovered through soil flotation from trench B1a and have been dated to the Final Neolithic Phase (c.4500–3200 cal BC) (Table 20.5). There is also a Final Neolithic mandible from trench LAI. One species has been differentiated via Geometric Morphometrics Analysis on first lower molars (m1) attached to the mandible and a predictive approach based on a linear discriminant analysis (Papayianni *et al.*, in preparation). The results are

Table 20.1. NISP for micromammals per chronological phase

Specimen	E–F Neolithic	M/L Neo	L/F Neo	F Neolithic	Neolithic	Unknown context
atlas	1			1	1	
cervical			1	4	8	
thoracic				1	1	
lumbar		1		4	18	
sacral				2	2	
caudal		1	3	10	4	
femur			1, 1pe	8, 2de, 1s, 3pe		
humerus			3, 2de	7 (1 <i>Talpa</i> sp.), 8de, 2pe, 2s	1, 3pe, 1s	1de (<i>Rhinolophus</i> sp.), 1s
tibia/tibiofibula	1pe			5, 1pe, 1s, 2de	1, 2pe, 2de	2
ulna			2, 1pe	11, 3pe		
radius			1de	3, 3pe, 1de, 1s	2 de	
pelvis			3 ilia, 3 acetabula	7 ilia, 1 pubis, 2 acetabula	3, 2 ilia	2
scapula				2, 1pe		
calcaneus			2		1	
metapodial			3	26	3	
ribs			2	11	1	
talon			1			
epiphysis					4	
maxilla			1 (Murinae)	15 (Murinae)		
maxilla fragment			4	7		
mandible	1 (Chiroptera)	1 (Murinae)	7	18 (Murinae)	6	1 (Arvicolinae)
mandible fragment				1		
mental foramen				2		
M1/2			3 (Murinae)	1 (Murinae)	1 (Arvicolinae)	
molar		2 (Arvicolinae)	1 (Murinae)	1 (Arvicolidae), 3 (Murinae), 1 (<i>Vulpes</i> sp.)	1 (cf. Cricetidae)	
lower incisor		1		43		
upper incisor			1	30		
incisive bone				4		
petrous bone				2	1	
skull fragment	2			1		
zygomatic process				1		
Total	5	6	49	267	56	

key: pe: proximal end; s: shaft, de: distal end

Table 20.2. Reptile NISP per chronological phase

Species	EN/MN Vert	E–F Neolithic Jaw	Vert	Rib	L/F Vert	FN Vert	Limb bone
<i>Elaphe</i> sp.		1	48	3		6	
Colubridae	1		4		2		
Lizard						1	2

displayed on the plot of the figure CP II 44 and identify the occurrence of one species, the wild steppe mouse (*Mus spicilegus*) or the Balkan short-tailed mouse (*Mus macedonicus*).

MUS MACEDONICUS (BALKAN SHORT-TAILED MOUSE)
OR *MUS SPICILEGUS* (STEPPE MOUSE)

The first lower molar shape of wild *Mus* is characterised by a projection of the tE, evident also on the Alepotrypa

specimens (molar measurements in Table 20.6). The extant wild mice of Greece are *M. macedonicus*, which extends all over the mainland, and *M. spicilegus*, which is found only in the NE border of the country in a zone extending to Bulgaria. The Alepotrypa specimens belong clearly to a wild mouse and are closer to *M. spicilegus* rather than *M. macedonicus*; given the fact that we do not know the prehistoric biodiversity of both wild species, our find signifies an extension of *spicilegus* to the south, which does not exist any more.

Family: Cricetidae; Subfamily:
Cricetinae (hamsters)

One molar from the 'Neolithic' layer was attributed to cf. Cricetinae subfamily. The extreme state of its attrition, as well as breakage of its occlusal surface, did not permit further identification to genus/species level. Neither was the identification of its side-position feasible.

Table 20.3. Amphibian NISP per chronological phase

Date	E Neo.	EN/MN	L Neo.	F Neo.					Neolithic
Species	<i>Bufo bufo</i>	<i>Bufo bufo</i>	<i>Bufo bufo</i> <i>Rana</i> sp.	<i>Bufo bufo</i>	<i>B. viridis</i>	<i>Bufo</i> sp.	<i>Rana</i> sp.	cf. <i>Pelobates</i> sp.	Amphibian
angular maxilla				2			1		
parasphenoid frontoparietal		1				2			
humerus	1	2, 1s	1de	5, 1pe, 1de	2		11		
radioulna	1pe		1	4, 1pe				1	
dorsal vertebra					2				
ilium	3			2	4		2		
urostyle						1	2		
femur	1, 1de	1s		2	7				
tibiofibula	2	2		2	7		1		
tarsal				4	2				
phalange	1		1			9			1

Table 20.4. Bird NISP per chronological phase

	Late/Final	Final Neolithic	Neolithic
humerus	1		
coracoid		1pe (Passeriformes)	1de
tibiotarsus		1pe (Passeriformes)	1de
femur	1pe (Passeriformes)		

Subfamily Arvicolinae (voles)

The four Arvicoline molars were fragmented; subsequently occlusal measurements are unavailable and genus or species identifications were not possible. One molar comes from the 'Neolithic' layer, one molar is dated between c. 5,400 and 4,300 cal BC and two more are dated to the Final Neolithic (see also Table 20.5).

Order Carnivora

Family: Canidae

VULPES VULPES (RED FOX)

One deciduous fourth premolar (dP4) of a young fox (*Vulpes vulpes*) was recovered from a Final Neolithic context (see Table 20.5). More specimens belonging to the fox are published with the large mammal material (Hadjikoumis, this volume).

Mammal post-cranial material

The micromammal postcranial bones belong to small-sized rodents, i.e., voles of the Arvicolinae subfamily and mice of the Murinae subfamily; of interest are the large-sized limb bones and pelves belonging probably to a large-sized *Apodemus* that were recovered from Θ 10, as well as Z/22a in the 1971 and 1996 campaigns. There is one femur dated to the Late/Final Neolithic period that belongs to a small-sized insectivore, probably a shrew of the Soricidae family and a humerus of a mole (*Talpa* sp.) from a Final Neolithic context. Breakage of cranial and postcranial material has been categorised according to Andrews (1990, 18, 51, 56) and is shown in Tables 20.7 and 8.

Non-mammalian material

Snakes of the Colubrinae subfamily, as well as unidentified lizard limb bones were recovered (Table 20.2). The majority of the snake vertebrae belong to a snake of the *Elaphe* genus, either *E. longissima* or *E. quattorlineata*. The amphibian bone material belong to toads (*Bufo bufo*, *B. viridis*, cf. *Pelobates* sp.), some of which must have been aged as their bones are completely fused, and a few belong to frogs (*Rana* sp.) (Table 20.3).

There are occasional bird bones – small, they belong probably to the Passeriformes family, being of the *house sparrow* or *swallow* size (*Passer domesticus* and *Hirundo rustica* respectively) (Table 20.4). We should note that bird bones larger than the Passeriformes family have been classified with the large mammal material, due to an unintentional sampling/storing bias (Hadjikoumis, this volume).

Microfauna and palaeoecological reconstruction

The retrieved micromammal material suggests a wild rodent population to be associated with the vegetation around Alepotrypa. Some voles of the Arvicolinae subfamily are steppe or meadow dwellers, others are found around water bodies, while yet others prefer dense herbaceous vegetation or broad-leaved or coniferous forests (Krystufek and Vohralik 2005, 147, 160, 161, 196). Some hamsters of the Cricetinae subfamily can be located in open dry habitats, like steppes, deserts or plains, but also in river valleys or on agricultural lands (Carleton and Musser 1984; Nowak 1999). The Balkan short-tailed mouse is located at altitudes lower than 500 m and is considered to avoid human dwellings (Mitchell-Jones *et al.* 1999). It can occupy a variety of habitats including crop fields, olive groves and dry shrubby areas (Mitchell-Jones *et al.* 1999). The wild steppe or Balkan mouse population of Alepotrypa is also indicative of open dry environment or Mediterranean woodland. *M.spicilegus* can also be found in cultivated

Table 20.5. Micromammal dentitions per chronological phase

Date	EN-FN	M/L Neolithic		L/F Neolithic		F Neolithic						Neolithic			No context	
Species	Chiro.	Arvic.	Mur.	Apod.	Mur.	Mus	Apod.	Rattus	Mur.	Arvic.	Vulpes	Arvic.	Crice.	Mur.	Apod.	Micro.
Mandible	1R		1L		1L	4R-3L	5R-4L	1L	3L-2R					2L	1L-2R	1L
maxilla		2		1		4L-1R	5L-4R		1	1			1			
broken molar																
m1																
m2						1L	1R			1						
m3																
M1																
M2				1R			1L-2R					1				
MP4																

key: Chiro. = Chiroptera; Arvic. = Arvicolinae; Apod. = Apodemus; Cric. = Cricetidae; Micro = Microtus

Table 20.6. Dental measurements of micromammals. *N*: Number of specimens, *Sd*: standard deviation

	Length (mm)				Width (mm)			
	Mean	Range	N	Sd	Mean	Range	N	Sd
<i>Mus spicilegus</i>								
m1	1.54	1.48–1.63	7	0.054	0.94	0.873–0.987	7	0.034
m2	1.02	0.966–1.08	6	0.049	0.92	0.873–0.94	6	0.023
m3	0.66	0.599–0.7	3	0.054	0.66	0.621–0.696	3	0.038
M1	1.76	1.73–1.8	3	0.036	1.14	1.11–1.19	3	0.042
M2		1.06	1			0.97	1	
<i>Apodemus sp.</i>								
m1	2.13	1.61–2.35	8	0.259	1.29	0.987–1.42	8	0.150
m2	1.44	1.1–1.63	7	0.197	1.34	1.1–1.64	7	0.182
m3	1.16	1.03–1.31	3	0.14	1.16	1.13–1.18	3	0.025
M1	2.34	1.7–2.62	10	0.345	1.50	1.12–1.63	10	0.193
M2	1.48	1.18–1.63	5	0.177	1.42	1.08–1.52	5	0.188
M3		1.19	1			1.1	1	
<i>Rattus sp.</i>								
m1		2.44	1			1.34	1	

Table 20.7. Breakage degrees for postcranial micromammal material (after Andrews 1990)

Postcranial breakage	Distal end	Proximal end	Shaft	Complete
Early to Final Neolithic				
humerus				
ulna				
radius				1
femur				
tibia		1		
Late/Final Neolithic				
humerus	2			3
ulna		1		2
radius	1			
femur		1		1
Final Neolithic				
humerus	7	2	2	6
ulna		3		10
radius	1	3	1	3
femur	2	4	1	6
tibia	2	1	1	3
scapula		1		2
Neolithic				
humerus		3	1	
radius	2			
tibia	2	2		

land or orchards. They would have easily become the prey of owls or raptors and thus deposited in the Cave during the antiquity.

Taphonomic implications

The number of microvertebrate bones provides us with adequate data about the micromammal and amphibian

taphonomy, but only limited data on the taphonomy of reptiles and birds. Worthy of note are the following taphonomic implications, as suggested by the recovered specimens:

- i) some of the micromammal bones recovered from Niche Θ 9–10 during the 1971 campaign, together with some bones recovered in October 1993 from the ditch (Τάφρος), are yellow-white in colour, indicating the survival of collagen. The bones from the ‘ditch’ were recovered along with charcoal and carbonised grains; this is clear evidence that the rodent bones were deposited *after* the carbonisation of the grains and that they post-date their context. Few dentitions remain, but there are enough post-cranial bones from these areas to comment. The species concerned are *Apodemus* sp., Cricetidae (hamsters) and Arvicolinae (voles). The size of the post-cranial bones indicates either a large *Apodemus* or a *Spalax* or *Rattus* sp. The last pair are typical burrowers, unlike the *Apodemus*, the hamsters and the voles. To sum up, the post-depositional intrusions noted above can be caused either by an animal in its burrow or by post-mortem deposition of a corpse by a predator.
- ii) the stalagmitic crust has affected the surface of a few of the microfaunal bones from B1α and Θ 9 in the same way that it did the human bones; this probably indicates that specimens were deposited after the onset of the stalagmitic activity, the dating of which is still controversial (see also Karkanas, this volume).
- iii) some of the bones (LA 1/216-7, 52κ) are coated with the black-burnt and greasy substance identified as

Table 20.8. Breakage degrees from cranial micromammal material (after Andrews 1990)

Date Element	MN/LN mandible	L/F mandible	maxilla	Final mandible	maxilla	Neolithic mandible
A		1			3	
B	1			5	3	
C		1		5	3	
D			1	4	2	
<D		2		5	2	
Infundibulum					4	1
Mental foramen				2		
Condylod process				1		
Massetic process						1
Zygomatic arch					7	
Incisive bone					3	

burnt animal dung. We can assume then that they were deposited simultaneously with or a little after the burning of the dung.

- iv) some of the *Mus* molars betray light enamel erosion, arguably caused by predator digestion; these molars were excavated from the anterior part of the cave (Trench B1 and B1a/Final Neolithic horizon). The digestion category is 2 or 3 according to Andrews (1990, 75). The predator could have been an owl of either the *Bubo* genus, like *B. africanus*, *B. scandiacus*, or *B. bubo* or of the genus *Strix*, like the *S. nebulosa* or *S. aluco*, according to Andrews (1990, 75). Owls swallow their prey whole; during the digestion process they regurgitate a pellet, containing the indigestible parts of the prey, like the fur or feathers and the bones. The predation activity must have happened during a period when no humans were using the anterior part of the cave, or it could be a totally post-depositional event, occurring after the sealing of the cave's entrance or even in the recent past, when the cave was reopened. The animal entrance (the 'foxhole') to the cave has not been identified, and so we cannot estimate the size of birds that could have entered. If the predation activity had happened during the Final Neolithic, then we might assume that the human occupation of Alepotrypa was not continuous during this period.
- v) post-depositional intrusion is also indicated by the *Rattus* sp. from Trench B1a. The rats of the genus *Rattus* are burrowers in the soil. One or some of them could have entered the cave through the fox-hole that betrayed the existence of Alepotrypa to the speleologists. The same behaviour can be attributed to the fox, who might have used Alepotrypa as a lair for its young, one of which lost its dP4 in the soils. In the same way other vertebrates may have entered the cave, like the predating birds, which would have needed a quiet place to digest their prey, or the hibernating snakes.
- vi) as we have only recovered half a bat humerus from an unknown context and a bat mandible from a

comingled context, the lack of chiropteran remains is an important indicator of continuous human use and occupation of the cave, until the event that caused its cessation.

- vii) the discovery of toad bones is to be expected in a place full of aquifers, and ending in a lake. No cut marks have been noticed on the toad bones, nor any evidence for their having been burnt/cooked on a fire; nevertheless a possibility of toad consumption cannot be excluded. We should keep in mind the collagen survival of many of the toad bones dated to the Final Neolithic: such argues for a possible modern intrusion into the layers. Finally, the majority of the toad bones were excavated during the earliest campaigns in Alepotrypa; thus we cannot be absolutely certain regarding their date.
- viii) the discovery of a 'set' of *Elaphe* sp. snake bones (one jaw, 48 vertebrae and 3 ribs) from the comingled Early to Final Neolithic layer in Niche Z/22a indicates the presence of an almost complete small-sized snake. Some of the vertebrae betrayed evidence for predator digestion, so this particular specimen could have been brought into the cave by a predator, avian or mammalian, and consumed close to where it was found. This is then a case of an intrusion in the archaeological stratigraphy: easily explained as part of the comingled nature of the layer in question.

Commensalism? in Alepotrypa – food for thought

As described in the introduction (Papathanasiou, this volume), large vessels and pits were unearthed in the anterior part of Alepotrypa Cave, which point to crop or other food/liquid storage, as well as to everyday use of the cave. A house mouse presence within the vessels or the pits would be expected, if the pits had contained non-liquid food, as in the case of the PPNB pits in the village Kissonerga-Mylothkia in Cyprus or the storage pits of the Chalcolithic Ocular Tepesi settlement in Azerbaijan (Cucchi *et al.* 2005 and 2012).

Since the *Alepotrypa* pits and vessels were not sampled by flotation/sieving during the early campaigns, there is no solid evidence for an infestation of the stored grain or other foodstuffs by the house mouse. If the interior of such pits had been sampled and floated without yielding any evidence for microfauna, then one could hypothesise that the pits were sealed in some way to avoid invasion by fungi or rodents.

The only mice found in the cave are the steppe mice, *Mus spicilegus* and the wood mouse, *Apodemus* sp. Although they are not typically commensal species, they can occupy the commensal niche near the anthropogenic habitat prior to the arrival of the house mouse in a region. This was the case of Neolithic settlements in France (Vigne 1997), where *Apodemus* has been found as a commensal. Furthermore, the wild *Mus macedonicus* was found in the Late Natufian deposits of Ain Mallaha settlement in Israel in sympatry with the house mouse indicating a seasonal occupation of the site (Weissbrod *et al.* 2017). The fragmentary evidence of *Alepotrypa* cannot offer us a clear image of the commensal niche during the cave's occupation. They can rather hint the existence of alternative commensals in the human habitat around the cave captured by predators.

Conclusions

The results of the microfaunal analysis from *Alepotrypa* Cave, given the methodological problems mentioned in the beginning of this chapter, are too limited to give us a more comprehensive image of the microhabitats within and around the cave. They offer hints for a rocky, steppe environment and they demonstrate intrusive activity of burrowers and predators. They also offer an alternative to the commensal niche prior to the arrival of the house mouse in Greece.

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Note

- 1 We do not know whether this was dry or wet sieving, or flotation targeting archaeobotanical data.

Bibliography

- Andrews, P. (1990) *Owls, Caves, and Fossils*. Chicago.
- Carleton, M. and Musser, G. (1984) Muroid rodents. In S. Anderson and J. Jones (eds) *Orders and Families of Recent Mammals of the World*, 289–379. New York.
- Cucchi, T., Vigne, J.-D. and Auffray, J.-C. (2005) First occurrence of the house mouse (*Mus musculus domesticus* Schwarz & Schwarz, 1943) in the Western Mediterranean: a zooarchaeological revision of sub-fossil occurrences. *Biological Journal of the Linnean Society* 84, 429–445.
- Cucchi, T., Bălăşescu, A., Bem, C., Radu, V., Vigne, J.-D. and Tresset, A. (2011) New insights into the invasive process of the eastern house mouse (*Mus musculus musculus*). Evidence from the burnt houses of Chalcolithic Romania. *The Holocene* 21, 1195–1202.
- Cucchi, T., Auffray, J.-C., Vigne, J.-D. (2012) History of house mouse synanthropy and dispersal in the Near East and Europe: a zooarchaeological insight. In M. Macholan, S. J. E. Baird, P. Munclinger and J. Piálek (eds) *Evolution of the House Mouse*, 65–93. Cambridge.
- Hillson, S. (2005) *Teeth*. (Cambridge Manuals in Archaeology). Cambridge.
- Kapantaidakis, M., Gianakakis, T., Mylonas, M. And Lyberakis, P. (2010) Νέα δεδομένα για την κατανομή των ειδών του γένους *Apodemus* (Rodentia: Muridae) στην Ελλάδα. In 5^ο Πανελλήνιο Συνέδριο Οικολογίας “Οικολογικές διεργασίες στο χώρο και το χρόνο”, Πάτρα 7-10/10/2010.
- Kryštufek, B. and Vohralík, V. (2005) *Mammals of Turkey and Cyprus. Rodentia I: Sciuridae, Dipodidae, Gliridae, Arvicolinae*. Koper.
- Mitchell-Jones, A. J., Amori, G., Bogdanowicz, W., Kryštufek, B., Reijnders, P. J. H., Spitzenberger, F., Stubbe, M., Thissen, J. B. M. Vohralík, V., Zima, J. (1999) *The Atlas of European Mammals*. London.
- Nowak, R. M. (1999) *Walker's Mammals of the World*, II. Baltimore and London.
- Papathanassopoulos, G. A. (1966) Το Σπήλαιο Αλεπότρυπα στο Διρό Μάνης. In G. A. Papathanassopolulos (ed.) *Νεολιθικός Πολιτισμός στην Ελλάδα*, 80–84. Athens.
- Papayianni, K., Debruyne, R., Cersoy, S. Zazzo, A., Denys C. and Cucchi, T. in preparation. MOUSETRACK: documenting the house mouse dispersal from the Neolithic of the Levant towards the Aegean and the South Balkans using geometric morphometrics and aDNA analyses.
- Reumer, J. W. F. (1986) Note on the spread of the black rat *Rattus rattus*. *Mammalia* 50, 118–119.
- Szyndler, Z. (1991) A review of Neogene and Quaternary snakes of Central and Eastern Europe. Part I: Scolecophidia, Boidae, Colubrinae. *Estudios geologicos* 47, 103–126.
- Van de Weerd, A. (1976) *Rodent faunas of the Mio-Pliocene continental sediments of the Teruel-Alfambra region, Spain*. Unpublished PhD thesis, University of Utrecht, Netherlands.

- Vigne, J.-D. and Valladas, H. (1996) Small mammal fossil assemblages as indicators of environmental change in Northern Corsica during the last 2500 years. *Journal of Archaeological Science* 23, 199–215.
- Vigne, J.-D. 1997. 1. Les micromammifères au Néolithique final à Clairvaux-MM et Chalain 3. Contribution à l'histoire du commensalisme, in Pétrequin, P. (ed.), *Les sites Littoraux Néolithiques des Clairvaux-les-lacs et de Chalain 3 (Jura)*, 3, 3200-2900 av. J.-C., Maison des Sciences de l'Homme, Paris, 712–722.
- Vigne, J.-D. and Bailon, S. (2002) Incidence hygrométrique des 'petits âges glaciaires' subatlantiques sur les microvertébrés méditerranéens: exemple Corse. In H. Richard and A. Vignot (eds) *Équilibres et ruptures dans les écosystèmes durant les 20 dernières millénaires en Europe de l'Ouest. Actes du Colloque Internationale de Besançon, Septembre 2000*, 123–134. (Annales Littéraires 730, Série: 'Environnements, sociétés et archéologie' 3). Besançon.
- Weissbrod, L., Marshall, F.B., Vallac, F.R., Khalailyd, H., Bar-Oz, G., Auffray J.C., Vigne, J.-D. and Cucchi, T., Origins of house mice in ecological niches created by settled hunter-gatherers in the Levant 15,000 y ago, PNAS, www.pnas.org/cgi/doi/10.1073/pnas.1619137114.

Speleothems from Alepotrypa Cave: towards climate reconstruction

Meighan Boyd and Kathrin Holmgren

Introduction

The main aim of the Navarino Environmental Observatory's contribution to the Alepotrypa Cave narrative is to reconstruct the paleoclimate using speleothems (from the Greek: *spelaiion*, cave; *thema*, deposit) in order to provide a climate context for the archaeological record. Considering its wealth of archaeological sites, the Peloponnese region is only sparsely covered when it comes to paleoclimate data. Accordingly, the high-resolution climate reconstruction from this project will also serve to fill in the gaps in other climate records both with respect to geographical location and time. It will provide a valuable resource to climate modellers seeking to improve the accuracy of future predictions for this sensitive region.

Speleothems can function as a climate archive, preserving information about the time during which they formed. In the Peloponnese, with its limestone bedrock, and in cave environments that contain calcium carbonate (CaCO_3), speleothems are a common feature. Speleothem formation is a result first, of the percolation through the soil zone of precipitation (rain, snow, *etc.*) and of surface waters, and second, under high partial pressure, of the absorption of carbon dioxide (PCO_2) present in the soil from biological respiration and decomposition of organic materials. This water then moves through the limestone bedrock where it dissolves carbonate minerals, causing the water to become supersaturated in calcium, when a high PCO_2 is present. When the water seeps out into a cave, the PCO_2 level drops, causing the carbon dioxide to degas from the water and the excess calcium carbonate to precipitate as speleothems (Ford and Williams 2007; Fairchild and Baker 2012). The layers within speleothems are similar to growth rings within

trees in that their chemical composition and the thickness of their layers may be analysed to yield information on climate conditions. Variables such as rainfall amount, temperature, vegetation type and soil biological activity (McDermott *et al.* 2001; Lachniet 2009) may be studied using different analytical methods. Speleothems may also be radiometrically dated, using the uranium-thorium method (Hoffmann *et al.* 2007; Zhao *et al.* 2009). Under good conditions, this method can provide very precise dating and so allow climate data to be gathered at very high resolution. Combined with lamina counting, it is possible to analyse speleothems at an annual and even sub-annual scale. For samples associated with even older eras, new advances in the uranium-lead method have improved precision (Bajo *et al.* 2012): dating of samples up to 289 million years old is now feasible (Woodhead *et al.* 2010). Since caves act as a protected and closed environment, the potential for extensive records covering many thousands of years may be preserved for millions of years. The opportunity to study climate driver processes and long term climate variability is unparalleled.

Climate proxies in speleothems at Alepotrypa Cave

Many processes contribute to the observed climate signal in a speleothem. These may influence the signal differently by month, season, year, century or millennium, or on time periods as long as ice age cycles. Additionally, these factors will influence each cave site in a unique way, and so interpretation of the climate signal is specific to its location.

$\delta^{18}\text{O}$ is the proxy most commonly used to characterise speleothems. It provides a signal of the isotopic composition

of rainfall at the location above the cave (Lachniet 2009): it reflects moisture source, precipitation amount and/or cave temperature (McDermott 2004). At coastal sites, and at other cave sites in the Peloponnese (Finné 2014), there is often a correlation between precipitation amount and $\delta^{18}\text{O}$ variation. This correlation is currently being tested for Alepotrypa Cave using modern speleothems.

$\delta^{13}\text{C}$ is much more complex as a climate proxy, but can broadly be described as reflecting variations in vegetation type (C3 or C4 plants) above the cave, levels of soil biological activity and processes occurring along seepage and dripwater paths, in addition to local cave environment (Fairchild and Baker 2012). When working with both $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ it is preferable to have extensive monitoring studies, as well as access to modern speleothem material which can be tested against modern climate and weather data to verify the interpretations produced.

Trace elements, including metals such as magnesium and strontium, occur in very small amounts within the calcium carbonate. They can reveal information about the residence time in the bedrock of the water reaching the cave, and weathering processes (Fairchild and Trebel 2009). Such elements may also be tied to events such as volcanic eruptions (Badertscher *et al.* 2014). They can complement explanations reached via the $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ analyses, allowing a more nuanced understanding of the record. When combined with petrographic (microscopic) analysis of the crystal fabrics, these techniques can yield a great deal of information about the cave environment and climate at the time of speleothem growth (Frisia 2015).

Modern climate in the eastern Mediterranean

The current climate of the eastern Mediterranean is controlled by the geographical positions of the Azores high and the Icelandic low pressure systems (NAO-North Atlantic Oscillation) (Lionello *et al.* 2006; Harding *et al.* 2009). Due to the influences of the landmasses of Europe and Asia, the eastern Mediterranean experiences a more continental climate than the western Mediterranean, which is more strongly influenced by the Atlantic Ocean. As a result, temperature extremes in the eastern Mediterranean are more pronounced with drier conditions being dominant. The hot and dry summers result from a more northerly summer position of the subtropical high pressure systems, minimising cloud formation. This minimised cloud formation means that precipitation during this time is negligible, and humidity is low as the high summer temperatures increase evaporation. During the winter, the subtropical highs move south and moisture transport increases as easterly tracking cyclones from the North Atlantic produce mild, wetter conditions. Generally, along a south-east axis, the climate becomes drier and hotter, with exceptions for topographical influences such as high mountain areas. At high altitudes, severe winters

can occur and climate can be classified as alpine. In general, along the Hellenic arc from north to south, there is a natural gradient from wetter and colder to arid and hotter. On a west-east path within Greece the Pindus Mountains contribute to a strong rainfall gradient, causing the easternmost regions to receive two to three times less rainfall annually (Maheras *et al.* 2004).

At Methoni, 64 km east of Alepotrypa Cave, and at 53 m above sea level, the winter precipitation (October–April) makes up 70–80% of the annual total, with an annual average of 698 ± 151 mm (1951–2008). Temperature for the same period averaged $18.0 \pm 0.4^\circ\text{C}$ (Finné 2014).

Past climate in the eastern Mediterranean region 10,000 yr to 5,200 yr BP (8,000–3,200 BC)

Following the end of the last Ice Age, a warmer and wetter climate dominated the first 5,000 years of the Holocene period (12,000 yr BP). The transition from a cold and dry glacial climate facilitated the melting of ice sheets and a rise in sea level. Climate in the eastern Mediterranean moved from cool and dry to warmer and moister conditions, with trees and shrubs becoming more widespread as the steppe vegetation diminished. Between 9,500–6,500 yr BP (7,500–4,500 BC) increased monsoon precipitation in North Africa led to more runoff and a greater Nile discharge: this contributed to a freshening of the surface waters in the Mediterranean Sea. In turn this led to anoxic conditions causing sapropel S1 formation (an unconsolidated sediment rich in nitrogen, which is composed of semi-decomposed aquatic micro-organisms; such sediments typically form in oxygen-free bottom areas of lakes and seas) (Finné and Holmgren 2010). Around 8,200 yr BP (6,200 BC) there is evidence from the eastern Mediterranean of a cold and dry period lasting approximately 150 ± 200 years. This so-called 8.2 ka event is seen in many global records: it is tied to a shutdown of North Atlantic Thermohaline circulation as a result of input of cold freshwater from North American glacier lakes. In the eastern Mediterranean marine records from this period, a halt in sapropel formation and less anoxic (oxygen-poor) conditions are observed as a result of cool and dry conditions now being dominant. When Thermohaline circulation resumed, conditions returned to being slightly more moist and warm, but a gradual decrease in humidity in the eastern Mediterranean and a move to more arid conditions still continued until around 5,000 yr BP (3,000 BC). This period coincides with decreasing climate forcing through changes in solar insolation in the Northern Hemisphere, and so weaker North African monsoons leading to reduced Nile discharge; the salinity of the Mediterranean Sea rises, and circulation of the water column in the Mediterranean starts up again. (For more in-depth background information, the reader is directed to Finné and Holmgren 2010.)

NEO project and current results

In March 2012, Navarino Environmental Observatory (NEO) scientists were invited to Alepotrypa Cave to investigate the suitability of the site for paleoclimate studies; in July of the same year a research project was initiated in the form of a PhD project. To date a total of five field visits have been conducted under the supervision of Dr. Panagiotis Karkanas of the American School of Classical Studies. With each visit, measurements of temperature, humidity, and CO₂ levels were taken, and dripping water collected at many locations within the cave. These figures and values provide a baseline of the present-day cave environment which may be compared to modern environmental conditions and weather data. After an initial survey of the cave, a number of stalagmites identified as good candidates for paleoclimate study were approved for removal. Each sample was carefully chosen to ensure that only useful specimens were collected. Sample locations in the cave are depicted in Figure 21.1.

After being collected, the stalagmites were sliced down the central axis (drip point) and two thick sections of 15 mm were then made for conducting the analysis. The strategy of sampling at a variety of locations within the cave was successful, as four of the stalagmites showed evidence of dark layers, likely resulting from human activity in the cave in the past.

Materials and results

Initial dating analysis has been performed at the Centro Nacional de Investigación sobre la Evolución Humana (CENIEH) and the Max Planck Institute for Evolutionary Anthropology (MPI-EVA) on stalagmites A1, A2, A3 and T1 using the U-Th method. More samples are currently being analysed at the Max Planck Institute for Evolutionary Anthropology. All dates presented here are shown in calendar years before present (yr BP).

The stalagmites analysed cover the time period 18,700–1,100 yr BP (16,700 BC–AD 900). Hiatuses in growth

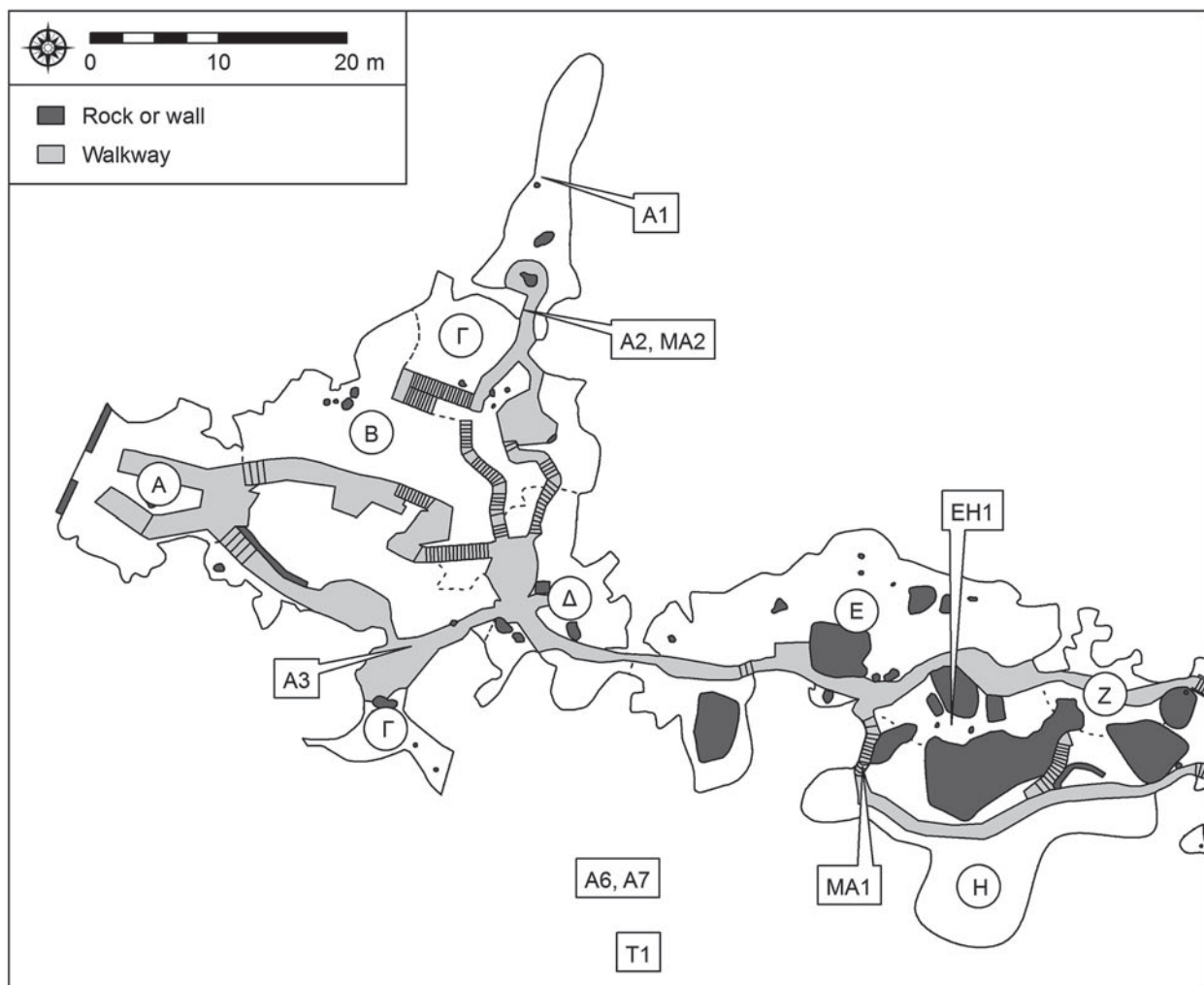


Figure 21.1. Map with locations of sample sites. A1, A2, A3, and EH1 are stalagmites that grew close to areas used by the Neolithic inhabitants, but which were not actively growing when sampled. MA1 and MA2 were actively growing stalagmites at the time they were sampled. MA1 was taken from a concrete stairway installed before 1970. A6, A7, and T1 are stalagmites collected from parts of the cave that have not been mapped, and with minimal evidence of human presence.

are noted: for A1, collected in Chamber G (Γ) north, a hiatus occurred from c. 17,000–c. 6,000 yr BP (15,000–c. 4,000 BC); for A2, collected in Chamber G (Γ) north, a hiatus occurred from 4,600–1,200 yr BP (2,600 BC–AD 800); and in the case of T1, collected in an unmapped section of Chamber G (Γ) south, a hiatus runs from 68,000–18,500 yr BP (66,000–16,500 BC). Stalagmites which grew after the suggested date of the earthquake which closed the cave (c. 5,200 BP/3,200 BC) or before the known period of human occupation (beginning c. 8,000 BP/6,000 BC) are formed of dense and clean calcite, banded milky-yellow to white and clear. Between the U-Th dates of 18,400 yr BP and 5,800 yr BP on A1 (Figure 21.2), there is evidence of sooty organic material in the stalagmite. Stalagmite A2 (Figure 21.3) was precipitated on top of a layer of this sooty material, and has a base date of 4,500 yr BP. This sooty material is found throughout the cave, and is most prominent in areas strongly associated with intense human activity. Therefore, its occurrence in the speleothems can reasonably be associated with the period humans were using the cave. Samples taken closest to the heavily used areas are the most strongly affected: they provide material of sufficient quality for paleoclimate analysis only before and after this very intense input of sooty material. By contrast, samples taken in more remote areas of the cave away from areas of intense human activity show this dark material, but are still of sufficient quality to be useful for analysis even during this period. This darker material will give us insights into which elements humans were being added to the cave air, and may reveal the materials being used in various tasks.

Paleoclimate proxy analysis

During 2014, stable isotope samples were taken from A1, A6 (Figure 21.4), and EH1 (Figure 21.5) at 0.25 mm resolution, while stalagmites A2, A3, A4, A6 and MA2 were sampled at 1 mm resolution. Stable isotope samples were analysed at the University of Innsbruck, Austria. Sampling at 1 mm intervals allows for the identification of periods of interest, which may then be sampled at higher resolution to identify and constrain climate events or transitions. Analysis of the two modern stalagmites, MA4 and MA5, will provide a baseline correlation between the amount and effect of precipitation (e.g., the relationship between greater rainfall amount and more negative $\delta^{18}\text{O}$ values in the samples) above the site with $\delta^{18}\text{O}$ in speleothems, and also the possible residence time of water within the bedrock. Petrographic analysis was conducted on the entire A1 stalagmite, and a growth hiatus topped by evidence of microbial structures below the 5,800 yr BP date was identified. The presence of coloured bands likely to have resulted from organic acids from the soil zone were seen in several areas of the stalagmite. Detailed interpretation of these results is forthcoming.

In January 2015, high resolution trace element analysis was conducted on samples A1, A6, and EH1 at the Max



Figure 21.2. Photo showing thick section scan of A1. U-Th dates were taken at (a) 18,600 yr BP (b) 5,800 yr BP and (c) 1,100 yr BP. Dark layer (d) indicates input of organic material and coincides with indications of growth hiatus and corrosion of calcite. This is likely due to the input of soot and other particles into the cave air by humans. Material towards the top of the stalagmite is clear and dense, and shows indications of having been precipitated in very stable cave conditions.

Planck Institute for Chemistry (MPI-C) in Mainz. Initial results indicate that good possibilities exist for being able to use trace element data to understand the drip history and bedrock/water interaction. Additionally, the results show exciting variations in elements associated with the burning of organic materials. These results are currently being used to interpret the frequency and

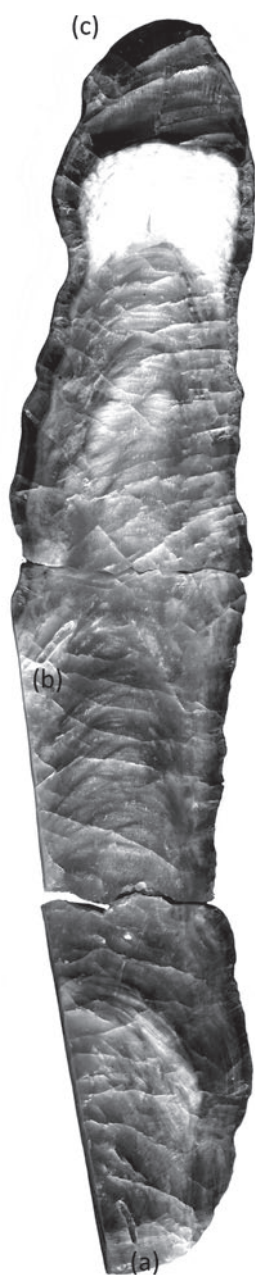


Figure 21.3. Photo showing thick section of A2. U-Th dates were taken at (a) 4,500 yr BP (b) 3,500 yr BP and (c) 1,200 yr BP. The entire stalagmite was precipitated on top of a layer of dark sooty material, but all the calcite within the stalagmite is clear and does not show evidence of input of sooty particles.

intensity of burning conducted within the cave. Taken together with stable isotope data, this may allow us to observe if this type of human activity is associated with climate variation.

Dating the abandonment of Alepotrypa Cave

In addition to work on speleothems, the NEO group has also provided U-Th dates on other calcite material from Alepotrypa Cave. Samples of calcite taken from crusts

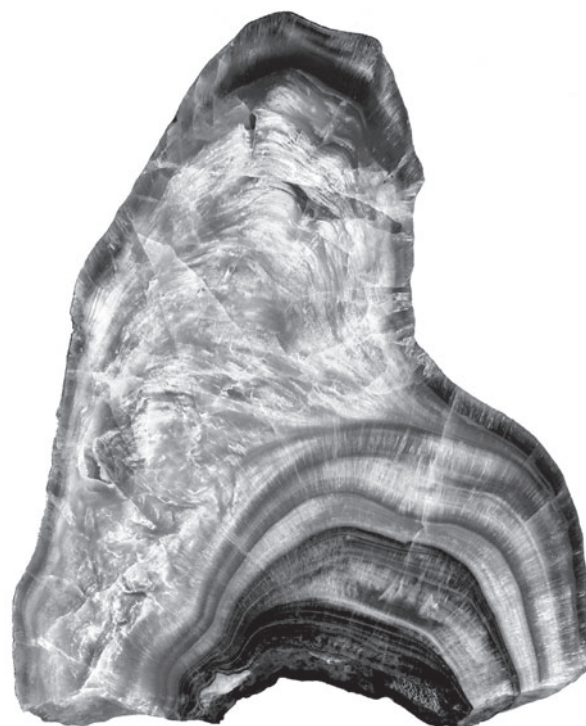


Figure 21.4. Photo showing thick section of A6. This stalagmite shows many layers which are very dark, and which occur in two sections. These dark layers are topped by clean, dense, calcite. As this stalagmite grew in a remote area of the cave, it is likely that the darker sections were able to grow even while the cave was in heavy use by humans.

found on human bones have produced dates which are consistent with their age. One sample from Chamber Z, area 24 produced a date of $4,220 \pm 470$ yr BP (Figure 21.6), and two samples from Chamber B, area 7 gave ages of $4,260 \pm 360$ yr BP and $4,360 \pm 230$ yr BP respectively (Figure 21.7). More crust material found in the multiple chambers is being analysed to ensure that the crust found throughout the cave was formed at about the same time, after the abrupt abandonment of the cave. Based on our observations we can deduce that the crust could have formed following a large collapse of the cave roof. The resultant closed cave conditions would have contributed to increased humidity and reduced ventilation, in combination with more efficient or altered dripwater flow into the cave. (Large changes and disturbances in the overlying bedrock can alter dripwater and percolation flow by enlarging existing cracks or creating new ones.) In this way more water could reach the cave, even if variation in precipitation rates was minimal. Initial new pathways can then become clogged due to precipitation of calcite within them in the bedrock, thereby reducing the amount of water reaching the cave. An increase in precipitation could be responsible for the calcite growth. This possibility will be examined in detail by paleoclimate proxy analysis in stalagmites A1, A2, A6 and A7.



Figure 21.5. Photo showing thick section of EH1. This stalagmite grew immediately adjacent to an area of heavy human activity. The dark, porous section in the middle (a) is underlain by dense calcite, and topped by dense, white calcite. By dating the material directly under and above section (a) we can work out when this section of the cave was used intensely. Trace element analysis on the dark material may give clues as to what compounds human activity was adding to the cave environment.

Summary

Archeologically well-studied areas such as Greece often lack high-quality, high resolution climate data. Caves present an excellent environment which preserves climate archives in the form of speleothems. These can allow us to provide accurate comparisons between key archaeological sites, such as Alepotrypa Cave, and amass paleoclimate data. Reconstructing paleoclimate records alongside archaeological excavations will greatly increase our understanding of the often intricate relationships between climate, physical environment and human actions. In particular, identification of rapid climate events and their relationship to changes in society require first a better understanding of both climate and societal variability at different levels on both the spatial and temporal scales before an objective



Figure 21.6. Photo showing bone sample surrounded by calcite crust. Bone was collected in Chamber Z, area 24. U-Th dates give an age of $4,220 \pm 470$ yr BP. (photo by Panagiotis Karkanas).

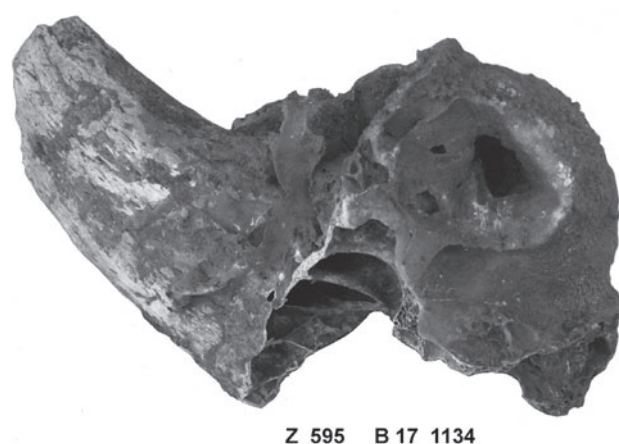


Figure 21.7. Photo of bone sample from Chamber B, area 7. Calcite crust from this bone produced U-Th ages of $4,260 \pm 360$ years, and $4,360 \pm 230$ yr BP respectively. (photo by Panagiotis Karkanas).

analysis can be drawn. These links can only be teased out through collaboration between experts in the respective fields. To be able to make robust correlations between archaeological and climatological data, the building of equally robust chronologies, such as those resulting from the application of U-Th dating, is crucial. Equally important is ensuring that short-lived events are captured at both ends. Speleothems from Alepotrypa Cave are being analysed at a very high resolution to produce just this type of record. This project may serve as a starting point for interpreting climate impact on social development over longer time scales.

Acknowledgements

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by Dr Dirk Hoffman at the Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany. Trace element analysis is being conducted at the Max Planck Institute for Chemistry in Mainz, Germany, by D. Klaus Peter Jochum in collaboration with Dr. Denis Scholz of Johannes Gutenberg – Universität Mainz. NEO would like to thank the Ephorate of Paleoanthropology and Speleology, and the Greek Ministry of Culture, Education and Religious Affairs, for permission to work in Alepotrypa Cave. We are also grateful to the Alepotrypa Cave team for the opportunity to participate in such an exciting interdisciplinary project.

Bibliography

- Badertscher, S., Borsato, A., Frisia, S., Cheng, H., Edwards, R. L., Tüysüz, O. and Fleitmann, D. (2014) Speleothems as sensitive recorders of volcanic eruptions: the Bronze Age Minoan eruption recorded in a stalagmite from Turkey. *Earth and Planetary Science Letters* 392, 58–66.
- Bajo, P., Drysdale, R., Woodhead, J., Hellstrom, J. and Zanchetta, G. (2012) High-resolution U–Pb dating of an Early Pleistocene stalagmite from Corchia Cave (central Italy). *Quaternary Geochronology* 14, 5–17.
- Fairchild, I. J. and Baker, A. (2012) *Speleothem Science: From Process to Past Environment*. Chichester.
- Fairchild, I. J. and Treble, P. C. (2009) Trace elements in speleothems as recorders of environmental change. *Quaternary Science Reviews* 28, 449–468.
- Finné, M. (2014) *Climate in the Eastern Mediterranean During the Holocene and Beyond: a Peloponnesian Perspective*. unpublished dissertation, Department of Physical Geography and Quaternary Geology, Stockholm University.
- Finné, M. and Holmgren, K. (2010) Climate variability in the Eastern Mediterranean and the Middle East during the Holocene. In P. J. J. Sinclair, G. Nordquist, F. Herschend and C. Isendahl (eds) *The Urban Mind: Cultural and Environmental Dynamic*, 29–60. (Studies in Global Archaeology 15). Uppsala.
- Ford, D. and Williams, P. D. (2007) *Karst Hydrogeology and Geomorphology*. Chichester.
- Frisia, S. (2015) Microstratigraphic logging of calcite fabrics in speleothems as tool for palaeoclimate studies. *International Journal of Speleology* 44, 1–16.
- Harding, A., Palutikof, J. and Holt, T. (2009) The climate system. In J. C. Woodward (ed), *The Physical Geography of the Mediterranean*, 69–88. Oxford.
- Hoffmann, D. L., Prytulak, J., Richards, D. A., Elliott, T., Coath, C. D., Smart, P. L. and Scholz, D. (2007) Procedures for accurate U and Th isotope measurements by high precision MC-ICPMS. *International Journal of Mass Spectrometry* 264, 97–109.
- Lachniet, M. S. (2009) Climatic and environmental controls on speleothem oxygen-isotope values. *Quaternary Science Reviews* 28, 412–432.
- Lionello, P., Malanotte-Rizzoli, P. and Boscolo, R. (eds) (2006) *Mediterranean Climate Variability*. Amsterdam.
- Maheras, P., Tolika, K., Anagnostopoulou, C., Vafiadis, M., Patrikas, I. and Flocas, H. (2004) On the relationships between circulation types and changes in rainfall variability in Greece. *International Journal of Climatology* 24, 1695–1712.
- McDermott, F. (2004) Palaeo-climate reconstruction from stable isotope variations in speleothems: a review. *Quaternary Science Reviews* 23, 901–918.
- McDermott, F., Matthey, D. P. and Hawkesworth, C. (2001) Centennial-scale Holocene climate variability revealed by a high-resolution speleothem $\delta^{18}\text{O}$ record from SW Ireland. *Science* 294, 1328–1331.
- Woodhead, J., Reisz, R., Fox, D., Drysdale, R., Hellstrom, J., Maas, R., Cheng, H. and Edwards, R. L. (2010) Speleothem climate records from deep time? Exploring the potential with an example from the Permian. *Geology* 38, 455–458.
- Zhao, J., Yu, K. and Feng, Y. (2009) High-precision $^{238}\text{U}/^{234}\text{U}/^{230}\text{Th}$ disequilibrium dating of the recent past: a review. *Quaternary Geochronology* 4, 423–433.

The Diros Project, 2011–2013: surface survey and site collection in Diros Bay

*Daniel J. Pullen, Michael L. Galaty, William A. Parkinson,
Wayne E. Lee and Rebecca M. Seifried*

We are delighted to contribute a chapter to this volume celebrating the life and work of Dr Giorgos Papathanassopoulos. Since 2010 we have worked with Dr Papathanassopoulos to place Alepotrypa Cave into a broader cultural and geographical context. In addition to conducting an intensive surface survey around the cave in Diros Bay, we also undertook geophysical research and excavation at sites in the region. Our preliminary report here focuses exclusively upon the results of surface survey.

The Diros Project is a systematic, diachronic, multidisciplinary, regional research project modelled on other similar Mediterranean examples (*e.g.*, Kea: Cherry *et al.* 1991; PRAP: Davis 2008). Our research team consists of an international crew of specialists, who work under the direction of Dr Giorgos Papathanassopoulos and are supervised by Dr Anastasia Papathanasiou of the Ephorate of Paleoanthropology and Speleology, through a permit from the Ministry of Culture and Tourism.

Despite difficult terrain, we explored as much of the ground surface as possible throughout the entire study region (CPII 46). During the course of three summer field seasons (2011–2013), we surveyed the entire permit study area through either intensive methods (*i.e.* tract survey) or through a more extensive methodology, and we conducted systematic surface collections at six additional sites (Sites 2–7; Figures 22.1 and 2).

Although our permitted study area was quite small, the distribution of cultural materials in the region indicates that Diros Bay was densely inhabited during the Neolithic period, at the same time that Alepotrypa Cave was being used. Although one site indicates some use during the Early Bronze Age (EH I–II), there are no additional substantial settlement sites in the region until the Classical

period. After that, the region was not extensively settled again until the end of the Roman period, and it remained the focus of a great deal of activity during the Byzantine and Ottoman periods. It had been densely inhabited until the last few decades, when many families moved to Athens or overseas.

Tract surface survey methods

Due to heavy macquis and poor visibility in many areas of the study region, we applied various field methods and technologies meant to aid survey, facilitate mapping and maximise data collection. The primary method was intensive survey (*i.e.* tract survey). A single team composed of 3–6 individuals and led by Wayne Lee and Rebecca Seifried conducted 23.5 days of off-site survey. During this time, the team covered a total of 2.47 km² in Diros Bay around Alepotrypa Cave. Parcels of land called ‘tracts’ were defined by Lee in the field and numbered in consecutive order (*e.g.*, Tract 1, 2, *etc.*). Some of these corresponded to bounded agricultural plots, but many were defined arbitrarily following natural and man-made boundaries, such as gullies and roads. A total of 330 tracts were recorded (Figure 22.3). The surveyors were spaced at intervals of 10–15 m, following a predetermined azimuth as best as possible. In some particularly overgrown fields, the surveyors adopted wider intervals and sought their best way through the vegetation; such tracts were labelled as ‘extensive survey’ in the database. As they walked, the surveyors scanned the ground surface and collected all small finds, including all chipped stone and ground stone artefacts, and all pottery larger than a thumbnail, unless it was obviously very modern.

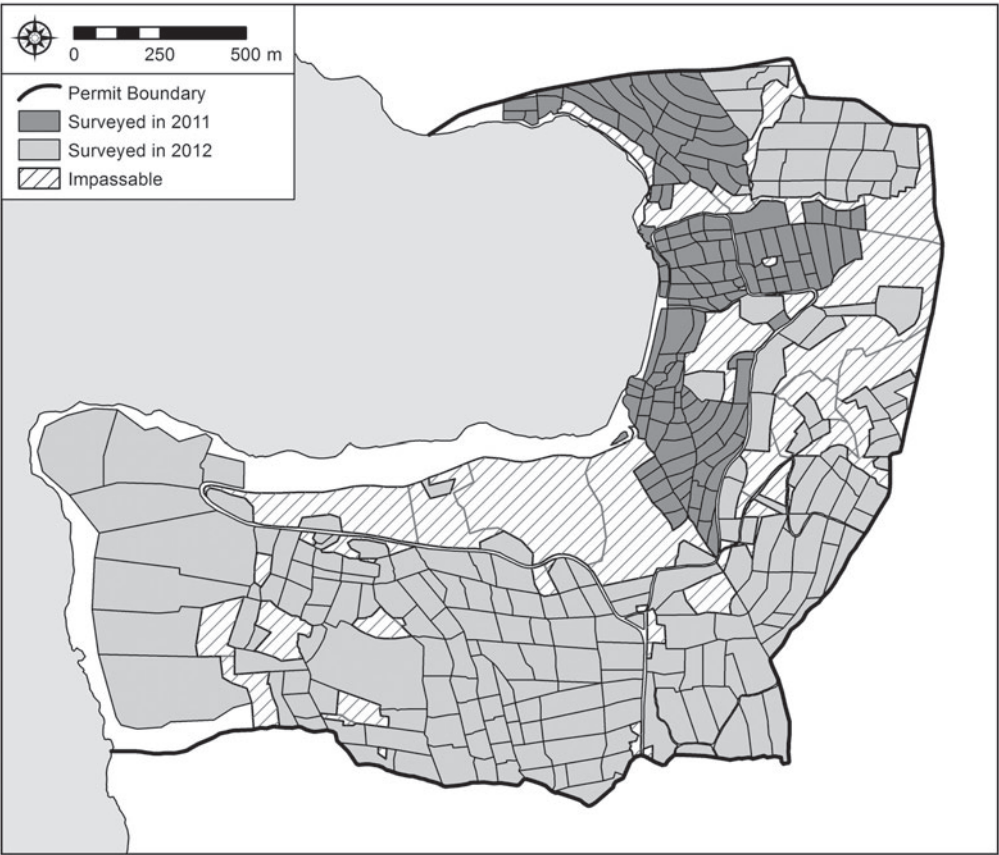


Figure 22.1. Map of study region showing tracts walked each year.

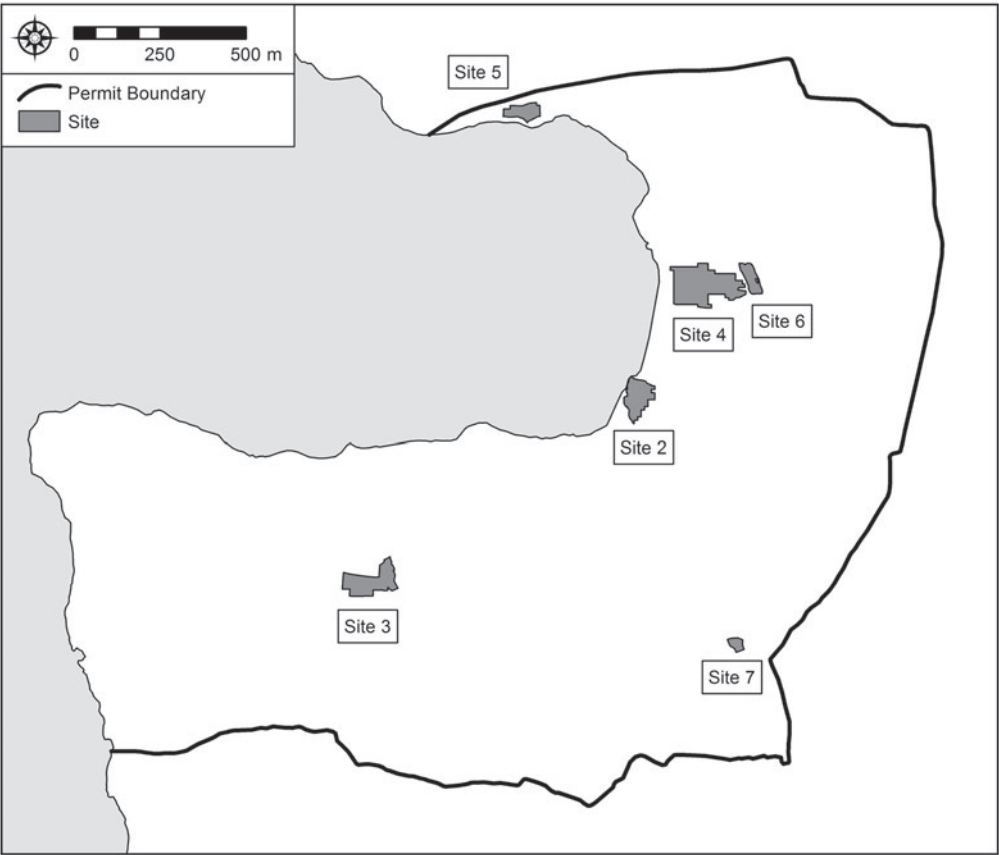


Figure 22.2. Map of study region showing sites.

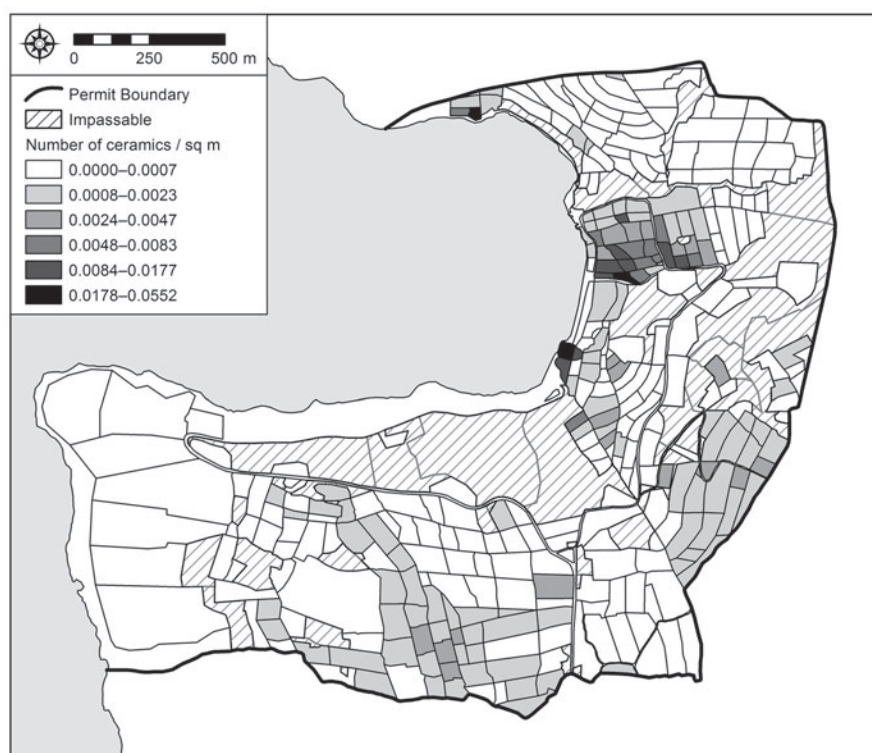


Figure 22.3. Map of study region showing tracts and ceramic densities.

In the 2011 season, the surveyors were joined in the field by a walker, Danielle Riebe, who carried a differential Global Positioning System (GPS) with real-time kinematic (RTK) correction. As Riebe walked along the centre of each tract, the GPS took continuous measurements in Universal Transverse Mercator (UTM) coordinates. These GPS transects were used to define the tract boundaries each evening in the project GIS, managed by Seifried. In 2012, the GPS system was used for other aspects of the project, and the survey team relied on more traditional map and compass work, aided by geo-referenced and detailed satellite photos (courtesy of Ktimatologio S.A. and the DigitalGlobe Foundation) and supplemented by a handheld GPS receiver. Lee also kept a hand-written journal describing each tract. Seifried entered more specific field data into a tract database on an Apple iPad tablet running FileMaker Go software (Figure 22.4). Together, Lee and Seifried recorded various data pertaining to each tract, including visibility (measured categorically as zero, low, medium, or high), vegetation types, associated structures (*e.g.*, *kalderimia*, *mandria*, terraces, *etc.*), cultigens (*e.g.*, olives) and any geological/soil observations. Any structure within a tract that was deemed highly important was designated a ‘feature’ and assigned a feature number (in consecutive order by tract; *e.g.*, Feature 1, 2, *etc.*). These features included farms, cisterns, churches, salt pans, inscriptions, and other immobile cultural objects. These features were revisited later and studied in more detail.¹

Before beginning work, the naming system for different collection units used in all of the Diros Project databases was standardised as follows: sites (S####), tracts (T#####), excavation units (EU####), and gridded collection units (SQ####).

Intensive site collection methods

During the course of tract walking we identified several dense concentrations of artefacts in addition to Site 1: Alepotrypa Cave (Figures 22.2 and 3). These included Site 2: Ksagounaki; Site 3: Pano Katozikia; Site 4: Kampinaria; Site 5: Mastakaria; Site 6: Ag. Theodoroi; and Site 7: Psiata.

To identify surface artefact patterns, measure site size, and clarify chronology, a gridded collection strategy was employed within these areas of high artefact density. At Sites 2 and 4, both of which were relatively open and flat, 10 × 10 m grids were established using the RTK-GPS. At the other sites, which were characterised by a more variable landscape and denser vegetation, roughly 20 × 20 m units were established using field walls and standing architecture as guidelines. A complete surface collection was conducted within each of the grid squares (*i.e.* ‘vacuum’ samples). To maximise efficiency and comparability of results, gridded surface collections were limited to 15 minutes per square, and walkers were directed to collect all small finds, lithics, tile, and pottery fragments larger than a thumbnail, unless they were

Diros Tract Database			
Tract Number (000#)	0120	Duplicate Record	Team A
Date Collected	7/10/2011	Unit ID T0120	Team Leader WL
Survey Method	Fieldwalking	Additional GPS	Data Entered By RS
Log Book Pages		Description	Team Members rs mg gv
Feature Number (00#)	001	Easting	Northning
View Feature Page		Survey Intensity	Intensive
Photo Number (T000#F00#0#) (T000#0#)	T0120F00101 T0120F00102 T0120F00103	Visibility	☐ Zero ☒ Low ☐ Medium ☐ High
			Number of Team Members 3
Field Counts			
Vegetation		Lithic Count 0	Tile Count 0
Macquis ☒ Y ☐ N Cultivated ☒ Y ☐ N Mixed Trees ☐ Y ☒ N Brush ☒ Y ☐ N Low Scrub ☒ Y ☐ N Grass ☐ Y ☒ N None ☐ Y ☒ N Other Vegetation		Pottery Count 10	Small Find Count 3
Cultigens		Lithics Collected	Small Finds Collected
Olives ☒ Y ☐ N Fruit Trees ☐ Y ☒ N Vineyards ☐ Y ☒ N Vegetables ☐ Y ☒ N Other Cultigens			other stone
		Pottery Collected	Geological Soil Observations
Structures			
Terrace Walls ☒ Y ☐ N		Cistern ☐ Y ☒ N	
Field Walls ☒ Y ☐ N		Well ☐ Y ☒ N	
Walled Field Road ☐ Y ☒ N		Road ☐ Y ☒ N	
Perm Field Building ☐ Y ☒ N		Path ☐ Y ☒ N	
Temp Field Building ☐ Y ☒ N		Kalderimi ☐ Y ☒ N	
Residence ☐ Y ☒ N		Mandri ☐ Y ☒ N	
Threshing Floor ☐ Y ☒ N		Other Structures	
Gourna 0			
Comment			
A curving terrace tract from below T0117-F001 to the east. Hits a boundary wall and the trail down to T0120-F001 (salt pans) and where small boats anchor.			

Figure 22.4. Example of tract data recording page from tablet.

obviously very modern. Collection units were numbered in consecutive order, starting at Square 1 for each site. Collection data were recorded on an Apple iPad in the field, employing a FileMaker Go database (Figure 22.5). The database was used to record visibility (measured in

percent and agreed upon by both the collector and the team leader), finds and field counts, distribution of finds within the square, amount of modern debris, surface vegetation, and other relevant information. Lee also kept a hand-written journal describing the day's work in general

Diros Collection Squares Database					
Site Number (00#)	004	Create New Record		Square Number (00#)	179
Site Name	Kampinaria	S004SQ179		Collector	WAP
Collection Type	Grid Square	EW	10	NS	10
Team Leader	RMS	Incomplete Unit		☐ Yes ☒ No	
Data Entered By	RMS	Number of Bags		Visibility (%)	8
		1		Standardized Visibility	
				Date Collected	7/16/2014
Finds ☒ Ceramic ☐ Bone ☐ Daub ☒ Lithic ☐ Metal ☐ Shell ☐ Other Stone ☐ Ground Stone ☐ No Finds ☒ Other...		Field Counts Ceramics 5 Lithics 1 Ground Stone Other 1 Distribution ☒ Concentrated ☐ Dispersed Modern Debris ☒ None ☐ Some 1-20 ☐ High 20+		Surface Vegetation ☐ Macquis ☐ Cultivated ☐ Mixed Trees ☐ Brush ☒ Low Scrub ☒ Grass ☒ Olives ☒ Fruit Trees ☐ Vineyards ☐ Vegetables ☐ None ☐ Other...	
		Surface Features ☒ Bedrock ☐ Terrace Walls ☐ Field Walls ☐ Rock Piles ☐ Path ☒ Other...		Thumbnail Rule? ☒ Yes ☐ No Time Limit 15 min	
Comment lots of plaster fragments in unit from cistern, concentrated mostly in one spot that was visible					

Figure 22.5. Example of gridded collection data page from tablet.

terms. Field boundaries were mapped in the GIS database at the end of each day.

Tract survey results

The survey region can be divided into five zones, corresponding to the shape of Diros Bay and the location of the project's permit boundary (Figure 22.6). The bay

is bounded by two large westward-projecting peninsulas, each of which rises steeply, even precipitously, to a high plateau; between them at the eastern end of the bay lies a relatively low, flat valley, defined at the water's edge by a white cobbled beach. The 2011 survey began on Ksagounaki Promontory, a small headland above and north of Alepotrypa Cave, then moved down into the valley, and finally up towards the valley's junction with

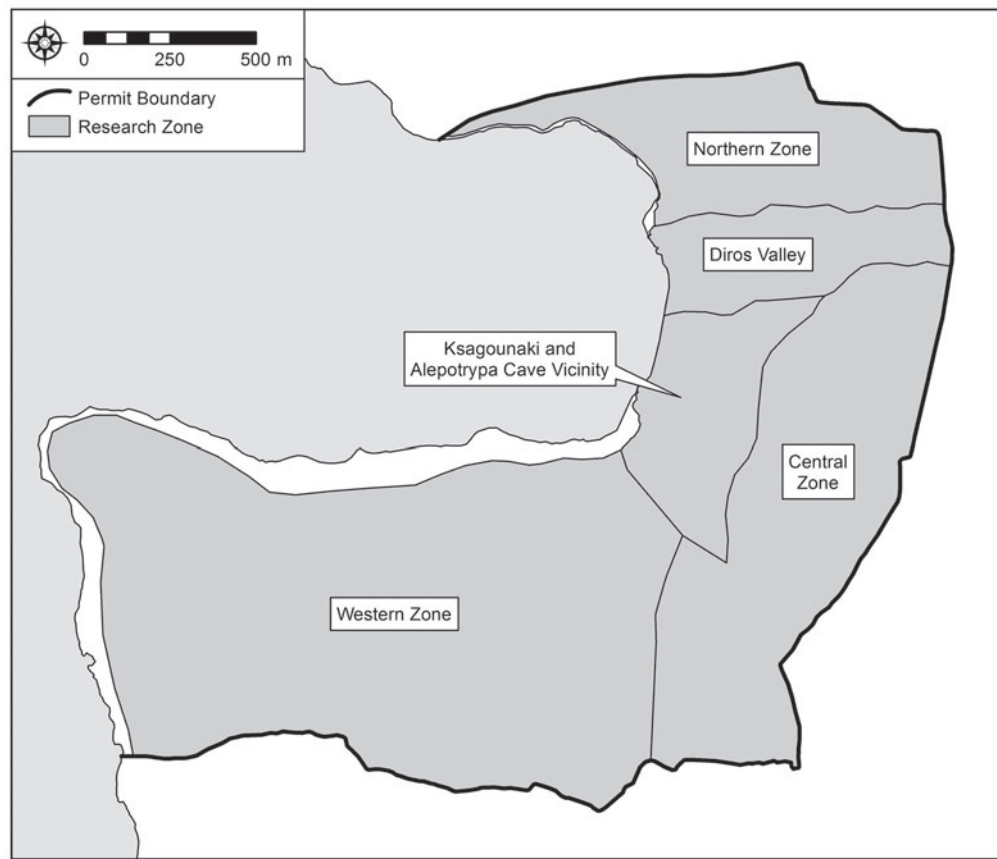


Figure 22.6. Map of the study region showing research zones.

the northern peninsula and the slopes above it. The towns of Pyrgos Dirou and Charia, south and southeast of the bay, are for the most part outside the permit area, but their respective fields that are within the permit boundary occupied much of our time during the 2012 survey season. The five zones covered by survey in 2011 and 2012 are: 1) Ksagounaki and Alepotrypa Cave vicinity; 2) the Diros valley; 3) the northern zone; 4) the western zone; and 5) the central zone. We also recorded local toponyms for the whole of the study region, which are described and used below (Figure 22.7).

Ksagounaki and Alepotrypa Cave vicinity

Previous reconnaissance by Papathanassopoulos and his colleagues had identified the small Ksagounaki headland or ‘acropolis’ above Alepotrypa Cave as the location of a substantial pottery and lithic scatter, and so we began the survey there. A *remma* (gully) drains the terrain above Ksagounaki, running over the top of the cave and terminating where the current museum sits. It proved a key survey boundary, since virtually all the fields immediately west of that *remma* proved almost entirely inaccessible. We surveyed back and forth across the Ksagounaki headland in a kind of slowly expanding fan, going up ever steeper slopes, sweeping from the *remma* above the cave around to the edge of the valley. Most of this area is terraced and

covered with relatively young olive trees – though there are a few fields where the trees are clearly older – and the lack of weeding and a relative dearth of sheep and goats has allowed the whole region to acquire a heavy cover of macquis and other forms of scrub vegetation.² As in most of the region around the bay, there is just enough pastoral activity here to generate winding paths along the terraces that allow reasonable visibility, but outside such paths the visibility drops to almost nothing. Where fields have been deliberately walled to exclude animals, the grass cover is almost complete, thus accounting for the substantial gap in survey coverage in the northeast part of this zone. Bedrock outcrops are common, and indeed dominate the Ksagounaki headland itself.

At the very western edge of the Ksagounaki headland, from the cliff edge extending approximately 30–60 m up the slope, we found a dense scatter of Final Neolithic ceramics and lithics, with the heaviest concentration in the northwest corner of the headland. We later gridded and collected this concentration as Site 2 (discussed below). The finds dropped off dramatically as the survey moved uphill from the concentration, but we also encountered our first more modern ‘feature’: a very substantial drystone walled compound, with a ‘tower’-like structure in one corner (standing to over 2 m, with a stone-framed window in one side), and in association with a number

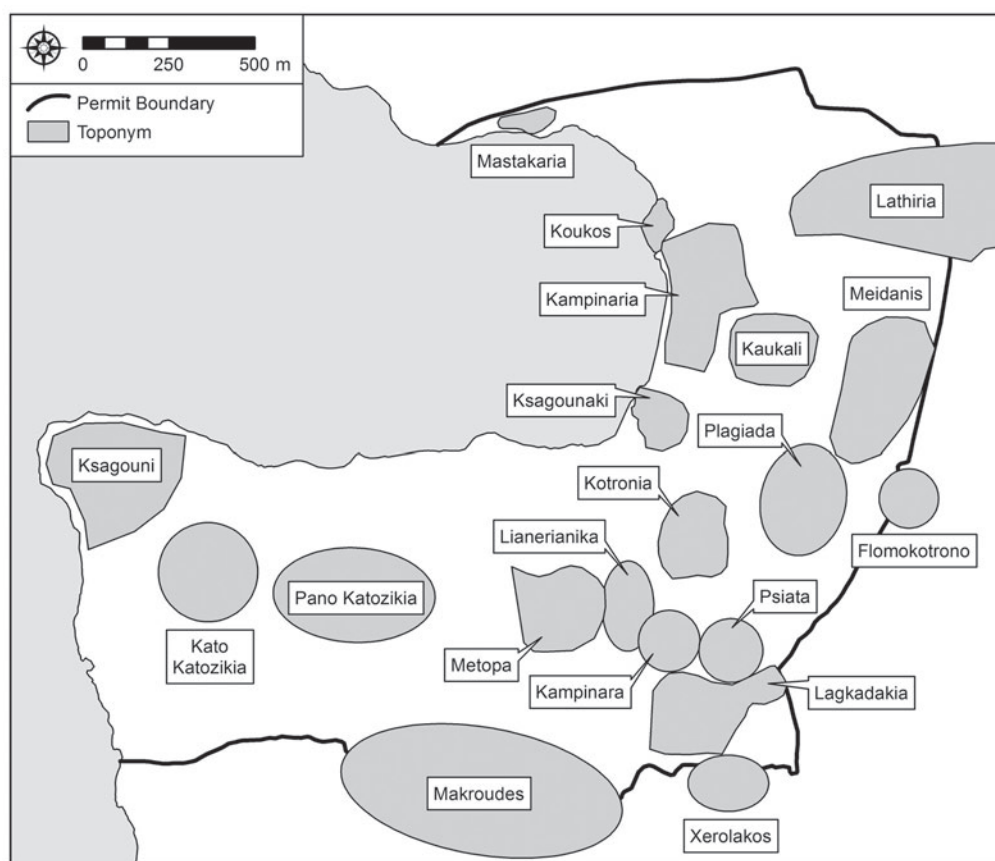


Figure 22.7. Map of study region showing toponyms.

of ‘*gournas*’ – pecked-out basins in large stones used for watering animals (a use later confirmed by local informants). The wall, substantial as it is, was probably merely a *mandri* or pen for animals. The tower is unusual, but in at least two other *mandria* we have found a separate small square structure in the corner of the larger walled area, presumably for the use of the shepherd. Throughout this area, and in the whole region of the survey, we found a wide assortment of terrace and wall types, varying from relatively expedient low walls made of small irregular rubble, to 1–1.5 m wide walls with two faces of laid stone (sometimes dressed) and filled with rubble (*i.e.* ‘double rubble’ masonry). We did not see any terraces created by bulldozer work, nor did we see any of the more sophisticated terrace construction types found elsewhere in Greece that incorporate stone steps or orthostatic niches, but some of the terrace walls here reach impressive proportions. Cutting across this area at a diagonal to the contours is a double-walled *kalderimi*, or stone-paved footpath, often associated with the Ottoman era. Where the *kalderimi* approaches the valley, just north of Ksagounaki and above the beach, it crosses in front of a recent, unfinished attempt to build on the foundations of an older structure set into the side of the hill, and associated with a small cave once used as a *mandri*. Immediately below this cave are the remains of a substantial limekiln or

kamini. Around the latter we found tile, seemingly modern in date, used in the construction of the kiln.

The Diros valley

The valley is bounded by the beach area itself and two *remmas*, one northern and one southern; it extends eastward to the permit boundary. The fields immediately above the beach, known as *Kampinaria*, extend eastwards toward a loop of the main road leading to the beach, at the corner of which lies the small church of Ag. Paraskevi (see below). The fields continue eastward beyond the road, still bounded by the *remmas*. The beach itself consists of a sloping area of cobbles shading to the north into a series of red cliffs known as *Koukos*. Immediately behind the beach proper is a long flat abrasion terrace almost completely covered with piles of beach cobbles. The local government spreads these cobbles onto the beach in an effort to make the beach more attractive. There is thus a lot of displacement and damage on the beach itself, and the abrasion terrace is in turn covered with massive rock piles. In the transition area between the cobbled beach and the red cliffs, however, we did find a few bits of obsidian, some pumice, and evidence of a possible walled building mostly buried in a Holocene soil deposit (three walls of the building were visible). The north–south wall of the structure is partially collapsed, exposed by wave

action and damaged by the government's beach work, and probably will be completely destroyed soon.

Above the beach road in the *Kampinaria* fields we found a wide and fairly dense scatter of Classical–Hellenistic pottery, stretching to the very eastern edge of the site around the church of Ag. Paraskevi. Visibility here is generally very good because of on-going herding by a goatherd who periodically rotates his flock through these fields. This density of finds persisted just east of the loop in the road, aided by the grazing flocks, but also marked by the presence of a ruined monastery complex. Here, just across the road from Ag. Paraskevi, is the ruined church of Ag. Theodoroi, which has a preserved apse and still visible frescoes and is associated with at least one other ruined building. As we worked through these fields, surveying back and forth between the two *remmas* and proceeding eastward, both visibility and finds declined until finally we stopped working in this area and moved to the northern zone.

Northern zone

At the bend in the road to the beach, at the northeast corner of *Kampinaria*, there is a footbridge across the northern *remma* that connects to a *kalderimi* running steeply across the slope toward Areopolis, forking at one point into a more modern, wagon-width road. A second *kalderimi*, now completely disused, also originates near here, following a parallel diagonal path across the slope, heading toward a hill with a tower complex outside our permit boundary. The two *kalderimia*, the coast and the permit boundary guided our survey of this region. Most of the upper slopes had recently burned, so the visibility was relatively high above the first few terraces (which remain overgrown). In the western section we found very few artefacts, but then suddenly, in the middle of an otherwise undifferentiated set of terraces, we hit a fairly strong concentration of obsidian (Tract 97, with two lithics; Tract 98, with nine; and Tract 98, with four). A very few other green-glazed, presumably Frankish/Byzantine sherds emerged in this area near the *kalderimi* (Tract 127). This area also includes a Modern house complex by the beach, and an Early Modern farm complex with a threshing floor, now being used to house cattle (Tract 123). Finally, on the very small headland near the edge of our permit boundary on the northern peninsula (Tracts 117–120), we found a substantial ruined drystone structure with some dressed stones, a doorway, and a window and internal partitions, supplemented by two parallel walls extending from the structure to the cliff edge – perhaps a residential or compound structure. Within those compound walls, and immediately to the west, was a relatively dense scatter of Roman and Medieval pottery. Visibility was quite variable here, and the overgrowth was very thick. A steep path connects the site to the water, among the rocks of which are many small salt pans.

While the western part of this area was surveyed in 2011, we returned in 2012 to complete the eastern section,

which sits north of the *remma* that drains into the centre of Diros Bay. The lower terraces in this eastern section, closer to the *remma*, are known as *Lathiria*. They were steep, terraced, grassy, but still marked by the recent fire, which made for fairly good visibility in these otherwise untended fields. The strong presence of obsidian finds we had discovered in 2011 to the west did not extend into the eastern area. Finds here, as we expected given the steep slope of the hillside, were very limited. The exceptions were primarily near the *remma* itself, where there was a major ruined cistern complex and gentler slopes.

Western zone

The tracts in the western zone occupy the area west and north of Pyrgos Dirou, defined by the main road on two sides, and by the sea to the west. This region presented two types of landscape: fields that were still cultivated (with olives), and those that were abandoned. The coastal plateau, including the *Ksagouni* headland, from the sea to where it rises to the next major plateau (marked by the modern church of Ag. Nektarios), is almost entirely abandoned. It bears few marks of past cultivation, and is now (at least in this area) the preserve of a small number of cows. It is entirely covered with macquis, and is seemingly equally devoid of artefacts. The ground cover forced us to survey it 'extensively', following animal paths in their winding way rather than using more precisely defined linear techniques. Despite the macquis, however, animal activity allowed for substantial visibility of the soil at times, providing some confidence in our assessment that the area lacks surface artefacts. Above the 100 masl line in the areas referred to locally as *Pano Katozikia*, *Metopa*, and *Makroudes*, however, cultivation has continued until more recent times. Most recently, the primary cultigen has been olives, many of which are still being tended at least minimally. The occasional threshing floors attest to earlier grain production. Visibility varied widely depending on individual landowners' activities, but this was essentially a rolling landscape of sometimes steeply terraced olives. The region also was dotted with several abandoned residential/agricultural complexes of stone cisterns, massive rubble-walled *mandria*, and field huts, or *spitakia*. Finds within this region were consistent, but thin. They included occasional lithics, some prehistoric pottery, and a regular scattering of green-glazed Frankish/Byzantine material, mixed with more recent Early Modern brown and yellow or 'blue-flower' glazed wares. Lithic finds intensified slightly in *Pano Katozikia*, downhill from and around a tight complex of very large walls defining a series of enclosures, some of which may have been building foundations (later defined as Site 3). Not surprisingly, the density of pottery finds increased as one approached Pyrgos Dirou.

Central zone

This same rolling, olive-cultivated, weedy landscape persists into the region north-east of Pyrgos Dirou,

extending east to Charia, and down into the Diros valley to the north. Here, however, it is much more punctuated with simply impassable macquis. This is especially true as one descends into the valley marking the head of the bay. However, further away from the coast and higher up, we found much more active cultivation (although still rough and spotty), and we continued to find a fairly regular scatter of artefacts, again blending small amounts of prehistoric material with Frankish/Byzantine material, but dominated by more recent Early Modern brown and yellow or ‘blue-flower’ glazed wares. Again, not surprisingly, the density of material increased as we approached Charia. Like *Pano Katozikia*, etc., here there were also some abandoned residential/agricultural compounds, mixed in with more current residential facilities, especially in *Kampinara*, where two of the modern roads come together.

Intensive gridded collection results

Based on the results of our tract walking, six additional sites were targeted for systematic surface collection. Site 2: Ksagounaki was collected in 2011, and the other five were collected in 2013. An additional 13 grid squares were collected from Site 4 in 2014.

Site 2: Ksagounaki (7,200 m²)

A total of 79 grid squares were collected on the site in an attempt to delineate more precisely the distribution of surface materials located in Tracts 1–6 (Figure 22.8). Of these, 60 were laid out as 10 × 10 m squares; the remaining 19 were smaller, accommodating the edge of the cliff that borders the site on two sides. A relatively well-defined spike in density over an area of about 50 × 50 m was identified at the northern edge of the Ksagounaki headland, with a significant amount of material located on the terraces immediately above the cliff that overlook the beach at Diros Bay. A less dense halo of material extended about 50 m beyond the dense scatter. The on-site artefact distribution is most probably the result of the site’s topography and hydrography, which channels water and artefacts towards the northern end of the headland. The site is Final Neolithic with a much smaller Mycenaean component; it was excavated during the 2011–2014 seasons. Excavation results will be published elsewhere.

Site 3: Pano Katozikia (9,450 m²)

A total of 23 units were defined here (Figure 22.9). On the eastern side of this site, units were defined in the field by massive piles of rubble and drystone masonry walls

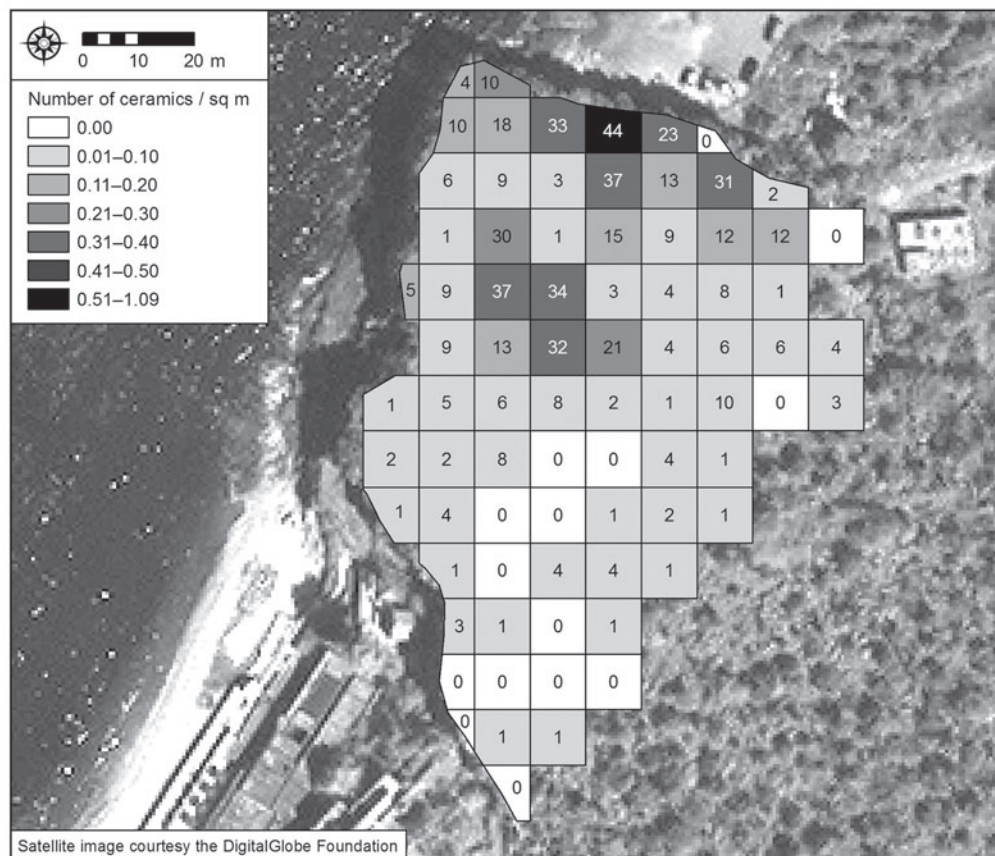


Figure 22.8. Density of ceramics from intensive collection at Site 2. Density is represented by shading. The total ceramic count is labeled in each unit.

that are unique to this site. Because of the size of some of these enclosures (mostly 20×20 m, but some 40×40 m), we placed two walkers in most squares. We maintained the roughly 20×20 m units in the western half of the site, with two walkers in these as well. The western area comprises typical north–south terraces with few olive trees, situated on a hill sloping toward the sea to the west. Throughout the site, visibility was extremely limited by grass, so walkers were not held to a time limit. Very little material was recovered in the enclosures themselves, although relatively high numbers of prehistoric pottery and lithics were recovered in the western half. We stopped collecting west following a drop-off in finds, and we could not access the next field to the north because of dense macquis and low visibility. We moved south for one pass east but found very little material.

Site 4: Kampinaria (18,200 m²)

This site is located in a flat area between two *remmas*, just east of the bay. During the collection period, the entire site was used by a local shepherd, who grazed his goats there daily. A total of 186 grid squares were collected (Figure 22.10). The majority of these were 10×10 m units, but 11 were slightly smaller to accommodate the slope just above the *remma* and the church of Ag. Paraskevi. Due to spikes in sherd counts in a few squares to the north,

we extended the grid northward with 20-m tapes. We also extended the grid eastward, into the yard of Ag. Paraskevi. Although tract survey had not identified a high ceramic density in the fields immediately around the church, the high grass had been mowed prior to site collection, enhancing visibility. Ceramic finds were concentrated in the centre of the site, with a spike in the eastern quarter, within the compound west of Ag. Paraskevi. Tile was not concentrated in a particular area. A few lithics were recovered on the western edge of the site and south along the *remma*. A few additional grid squares were collected in 2014 because the area between the church and the *remma* had been cleared, making the ground more visible. There is a very good chance that the dense ceramic scatter associated with Ag. Paraskevi is a continuation of the material found in Site 6, now interrupted by the paved road.

Site 5: Mastakaria (3,890 m²)

The site is located on the edge of a cliff overlooking Diros Bay. During the tract survey (Tracts 17–19), a large rectangular ruined structure was identified in the centre of the site, with rubble walls that stand to 1–1.5 m and have traces of a door and possible windows. A total of 20 collection units were defined according to visible boundaries, the structure's walls, rubble piles, field walls, and terraces (Figure 22.11). The units were generally $20 \times$

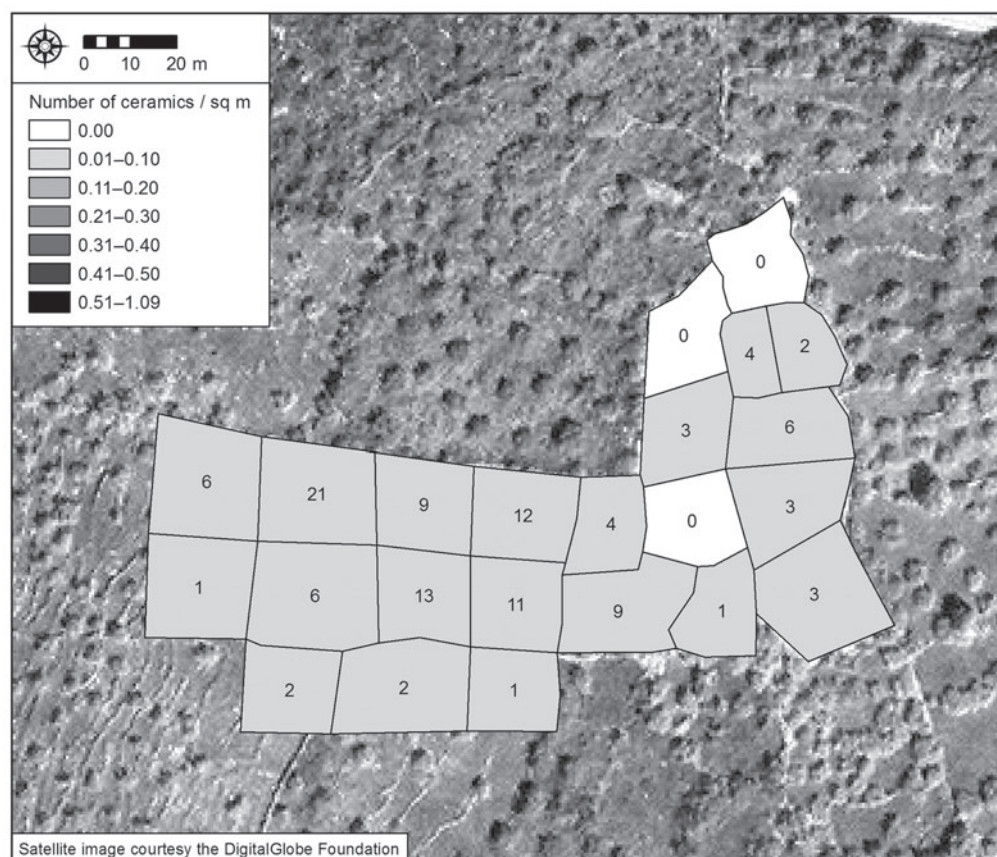


Figure 22.9. Density of ceramics from intensive collection at Site 3.

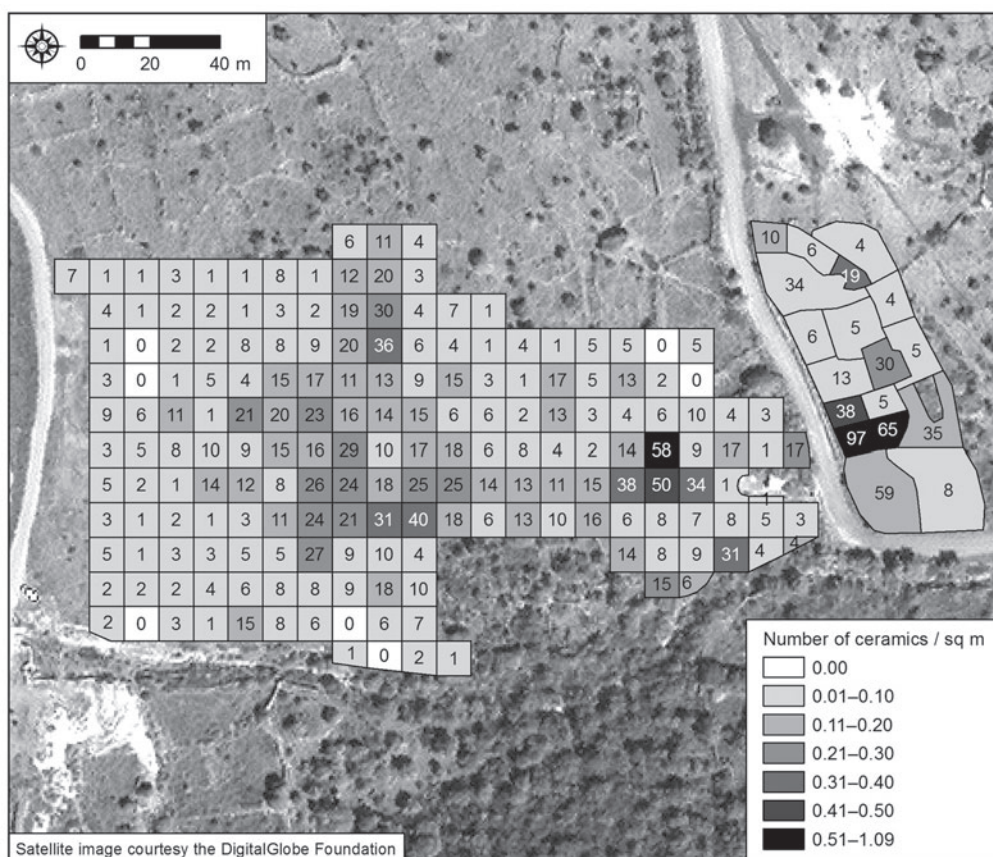


Figure 22.10. Density of ceramics from intensive collection at Sites 4 and 6.

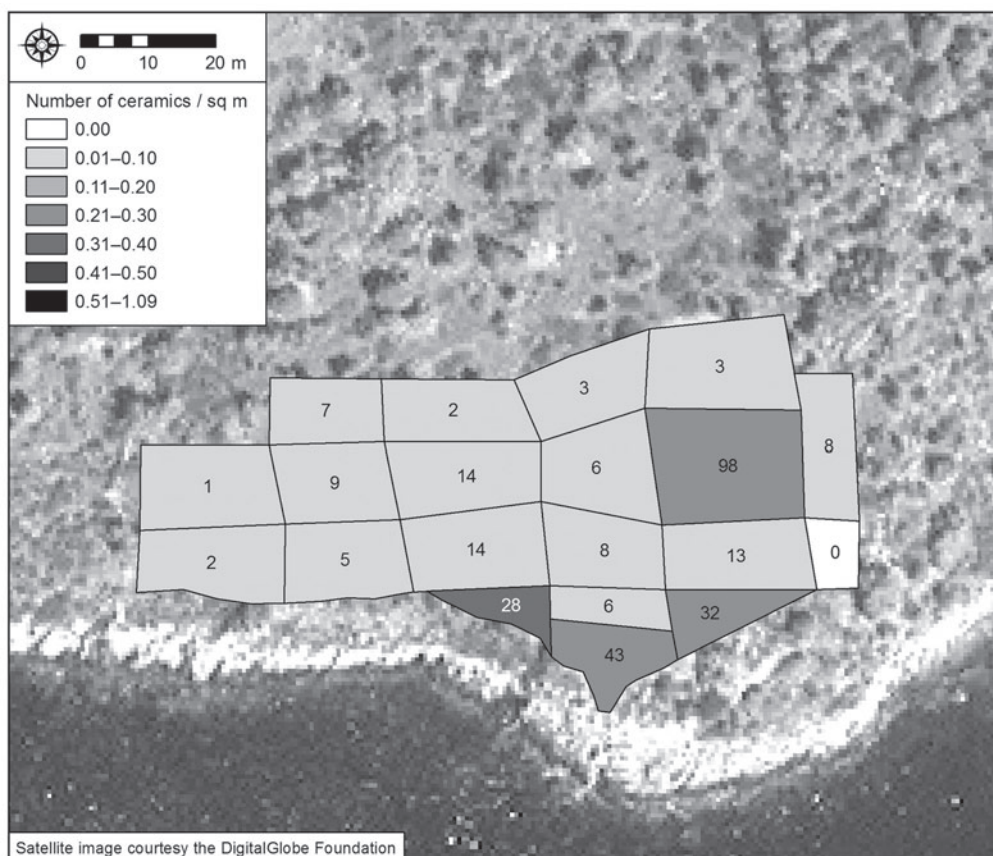


Figure 22.11. Density of ceramics from intensive collection at Site 5.

20 m in size, but smaller units were defined along the edge of the cliff. Vegetation was so dense that walkers needed more than 15 minutes to collect the units, so time limits were not kept. A high density of material was also collected down slope from the main structure along the cliff edge, probably due to the channelling of water and artefacts from the structure towards the cliff. The structure itself contained a high density of ceramics and tile, and an abundance of tile was also recovered in the squares north and south of the structure. No lithics were recovered.

Site 6: Ag. Theodoroi (3,270 m²)

A total of 18 collection units were defined in the field, using large rubble walls and structures as guidelines, including the ruined church building of Ag. Theodoroi and another structure we referred to as a monastery (Figure 22.10). Units in the yard south of the church entrance were set out with tapes in 10 × 10 m squares, but others varied up to 20 × 20 m. There was a high density of ceramic material in the churchyard, where visibility was best, but this varied dramatically across the site. The material was varied but small and poorly preserved, probably due to the use of this site by a local shepherd. Tile was concentrated in the two squares north of the ruined chapel, and no lithics were recovered. We found a large inscribed stone incorporated into one field wall east of the church, with

dots chiselled out at the ends and vertices of the letters, and lines incised to connect the dots. It reads: X K Ξ and is surrounded by a lightly incised box. The name of this site is tentative, due to confusion about the names and dates of the churches. Ag. Paraskevi, the extant chapel just west of Site 6, was reportedly founded in AD 1265–1275, though it has been confused with the church of Ag. Theodoroi, which was reportedly built in the area between AD 1300 and 1330. To add to the confusion, Ag. Theodoroi is in turn mixed up with an Ag. Nikon (see Drandakes 2009, 349–356). This muddle of names may help explain why two churches – one ruined, and one still in use – are located so close together; but as a result, our identification of the ruined church as Ag. Theodoroi should be considered as tentative.

Site 7: Psiata (1,300 m²)

The site is a ruined Early Modern tower house. We found so few finds while walking around the site that we chose not to define a collection square or conduct systematic collection (Figure 22.12). Visibility was somewhat limited by grass, but not enough to have interfered to a great extent. We found a small collection of Early Modern sherds and tiles in the yard south of the house entrance, and a number of large pithos fragments in the tile and wall rubble on the eastern side of the house. We collected

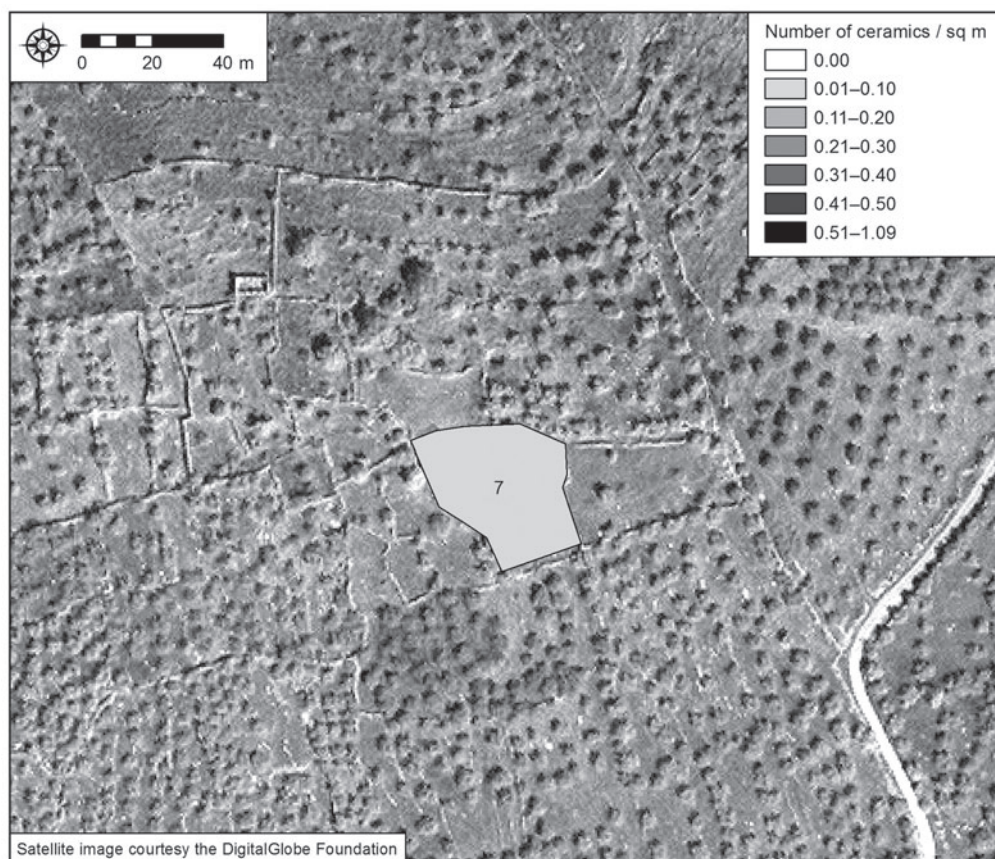


Figure 22.12. Density of ceramics from intensive collection at Site 7.

these materials and assigned them to Square 0. We also collected five mortar samples in the hopes that changes in mortar composition may provide a way to date Early Modern construction. Two of these samples were taken from a round, above-ground cistern in the south yard, which had been re-plastered at least once. Cement had also been laid on top, which covered an earlier surface containing a glazed ceramic inlet pipe protruding into the hatch. A carved marble hatch covering lay to the side. The other three samples were collected from the structures themselves and were associated with dates carved on the lintels: 1781, 1832, and 1849 (the last from a separate outbuilding).

Laboratory analysis methods

As described above, there were two phases of fieldwork involving archaeological survey: the general tract walking and the intensive site collections, often in 10×10 m grid squares. These two methods produced different quantities of material from collection units, with the intensive site collections often producing much more than the tracts, but the material from both collection methods was treated in a similar manner, so that there could be full comparability in the analysis. To that end, all the material recovered from the surface survey is recorded in the same database, with appropriate data fields to distinguish tract-walking units from gridded units.

The field team washed the material they brought into the Diros Museum on a daily basis, and left it to dry overnight. One of the lab assistants would gather and bag the dry items the following day, fill out the Survey Unit Materials Summary (SUMS) form, and bring the bags into the lab for processing. The SUMS form was designed to document any potential discrepancies between field and lab counts of material, as well as to document any discards (*e.g.*, of unworked non-diagnostic rocks visible after washing). Occasionally the survey team did not distinguish between tile and sherds, and given that many of the sites were tile-heavy historic sites, this led to a large number of changes in counts. Once the material from a unit was spread out for analysis, the final counts on the SUMS form were completed for tract or gridded site material.

Although the ChronoType methodology was not applied to the collection of materials in the field, the ChronoType recording system was used in the analysis of the survey materials (see Tartaron *et al.* 2006, 475–483). The ChronoType system has been successfully used on a number of regional surveys, including the Sydney Cyprus, Australian Kythera, Eastern Korinthia Archaeological Survey, and the Saronic Harbors Archaeological Research Project (see Gregory 2004 for fuller details of the ChronoType system and its theoretical basis). Rather than cataloguing each item individually, sherds and other items that seemed to be quite similar were grouped

together and recorded as one entry in the database, specifying the quantity. The ChronoType recording system is a hierarchical system that allows a range of identifications, from very specific ‘types’ commonly found in the archaeological record, to more general categories that because of preservation cannot be closely identified, such as worn, semi-fine micaceous orange body sherds. Associated with each of the ChronoTypes is a chronological range that likewise can be specific to a narrow time span (*e.g.*, Early Helladic II) or to a broader range (Classical–Hellenistic). One of the principals behind this system is that some kind of identification or elimination of possibilities as to type or chronological period is better than none.

Once the material was sorted and grouped, the actual recording process began. Here is where we believe we have provided an innovative process for the recording of surface materials. The materials from one unit were sorted and grouped on a blank sheet of paper in rows or groups, then a number beginning from 1 was written on the paper adjacent to the item. When needed, boundary lines were also drawn on the paper to mark groups. The entire unit was photographed with the unit tag from the field, the items turned over, and photographed again from the back. Subsequently, each numbered item or numbered group was photographed individually, front and back. The item numbers written on the paper became the catalogue item number. The survey unit number and item number were embedded in the photograph file names.

This method precludes the necessity of physically labelling the individual items recovered from the field. This was advantageous to us, as many of our sherds were small and worn, and applying inked numbers to them would have been tedious and/or would have rendered the sherd difficult to examine. The utility of this method was demonstrated when visiting scholars came to study the material. They could easily match the physical items to their number in the photograph, and edit the information for the database. If any of the material items were regrouped, or if groups were broken up because more specific identifications could be made for some of the group members, it was easy to retake the photographs with the new item numbers.

This system would work well on any survey project where the quantity of material from each unit is not overwhelming. It is time consuming to take the large quantity of photographs needed and then to renumber the photograph files with the unit and item number, but we believe it is more efficient than the traditional labelling of sherds. In the end this method provides a more permanent and versatile record of the material. Further, the process forces us to take a photograph of everything at the time of recording, thus fulfilling one of the legal requirements of archaeological permits granted by the Ministry of Culture in Greece. These photographs, coupled with the counts from the SUMS forms, allow for valuable cross-checking

when editing data; they are also a record of the unit's finds before the material is allotted to the various specialists and stored separately from the rest of the unit.

As of the end of the 2014 season, there are nearly 2,900 catalogue records in the FileMaker database for the c. 5,500 items recovered by the survey team from tracts and intensive site collections. The survey objects are documented by over 6,400 unit and item photographs. While this is a large quantity of photographs (totalling almost 22 GB in file size), the unit and item number are embedded in the photograph file names, making searches quite easy.

Preliminary analysis of the survey tract finds

The field walkers delineated 330 tracts in total, of which 88 had no finds – some in part due to problems of dense vegetation and poor visibility. Of the 242 tracts with finds, 1,910 discrete artefacts were collected and brought into the lab for analysis, yielding an average of 7.9 artefacts per tract. But the actual range in number of artefacts per tract was quite large: in addition to the 88 tracts with 0 items, 141 tracts had 1 to 5 items; on the other hand, the 10 tracts with the largest quantity of artefacts produced 28% of all artefacts. The two tracts with the highest number of artefacts, Tract 2 (85 artefacts) and Tract 3 (71 artefacts), correspond with Site 2: Ksagounaki, as might be expected. The other sites were likewise identified in part on the basis of large quantities of artefacts in tracts.

As is typical for Mediterranean surveys, the largest category of material recovered was ceramics, followed by chipped stone and tile. A breakdown of the quantities of material recovered across all tracts is given in Table 22.1.

The chronological distribution of materials recovered in the tracts reflects the chronological periods of the sites identified. The most common specific periods represented are Final Neolithic, Classical through Hellenistic, Roman, and Late Medieval through Early Modern. Many artefacts recovered could not, however, be precisely identified or dated because of their small size or poor surface preservation and were consequently placed into some of

the very broad periods such as 'Ancient Historic' (Archaic through Roman), 'Ancient Historic–Medieval' (Archaic through Late Medieval), and 'Medieval–Modern'. Further analysis may refine the chronological associations of some of these artefacts, but the overall picture is unlikely to change much.

The most surprising gaps in periods represented by surface finds in the Diros survey zone are:

- the lack of pre-Neolithic through Late Neolithic,
- the small quantity of Early Bronze Age,
- the near lack of Late Bronze Age and early Iron Age,
- the small quantity of Geometric through Archaic, and
- the small quantity of Early Roman.

Within the Mani itself many of these periods are known from excavated and unexcavated sites. The paucity of materials from these periods is likely due to the small size of our survey territory in combination with a lack of the particular geomorphological situations preferred for exploitation in those periods.

Preliminary analysis of the survey – intensive site collections

The survey team conducted gridded or spatially restricted collections at Site 2: Ksagounaki in 2011, and at four sites (Sites 3–6), plus one unit on a small site (Site 7) in 2013. Some additional grid squares were collected at Site 4 in 2014 when the absence of vegetation permitted. The quantity of material from the intensive site collection is summarised in Table 22.2.

At Site 2, a set of grid squares (SQ 31–38) was subjected to a 'thumbnail' collection of very small sherds and ceramic items. These tiny (less than 1.0 cm in maximum dimension) artefacts have not been included in the regular counts of artefacts recovered from the grid squares as their quantity greatly distorts the distribution of materials when plotting densities. However if one considers the weights of both the larger and the thumbnail artefacts from Site 2, there is not as much distortion. But since the thumbnail collection was not conducted over all of the Site 2 grid squares, these data are of limited

Table 22.1. Categories and quantities of material recovered from tract survey

Category of material recovered	No.	% of total recovered
Ceramics	1,626	85.1
Chipped stone	141	7.4
Tile	88	4.6
Other stone	28	1.5
Daub	13	0.7
Building material (mortar and cement)	6	0.3
Metal (modern)	5	0.3
Glass	1	0.1
Lamp (terracotta)	1	0.1
Modern materials	1	0.1
Total	1,910	100

Table 22.2. Number of subunits and artefacts for intensively collected sites

Site	No. subunits	No. artefacts*
2	79	679
3	23	123
4	186	1,850
5	20	410
6	18	530
7	1	13
Total	327	3,605

*This is the total number of all categories of artefacts after analysis in the lab. This does not include the 'thumbnail' collections of very small (< 1.0 cm in size) sherds from squares 31–38 at Site 2.

Table 22.3. Categories and quantities of material recovered from intensive site collection

Material recovered	No.	% of total recovered
Ceramics	3,202	88.8
Tile	298	8.3
Chipped stone	57	1.6
Daub	18	0.5
Other stone	14	0.4
Building materials (mortar and cement)	6	0.2
Bone	3	0.1
Metal	2	0.1
Glass	2	0.1
Shell	2	0.1
Figurine (terracotta)	1	0.1
Total	3,605	100

usefulness, and thus are not considered further in this report.

As with the materials recovered through tract walking, the largest quantity of material collected in the intensive site collections is ceramics (Table 22.3). Two significant differences between types of material collected during tract walking from material collected during intensive site collection are the larger quantity and frequency of roof tiles and the smaller quantity and frequency of chipped stone.

The assemblages collected from each of the six sites are different from one another in types of material and chronological range. Though the boundaries of the intensive site collection units do not always coincide with the boundaries of the tracts, the use of an RTK-GPS mapping system ensures that we can spatially align both. The following discussion of the assemblages from the sites combines material from the tract walking and the intensive site collections.

Site 2: Ksagounaki and Tracts 1–5 (898 items total)

The so-called ‘acropolis’ of Alepotrypa has long been known: a large quantity of obsidian and other items have been collected from the surface here since excavations began in the cave in 1970 under Dr Papathanassopoulos (as recorded in the Diros Museum catalogue). There is, however, a noticeable presence of later material, including that of the Classical–Hellenistic and Medieval–Modern periods, which comprise approximately 7–8% of the non-stone artefacts. But the Final Neolithic ceramic material far outnumbers that of all the other periods, representing over 70% of the total non-stone artefacts recovered by tract walking and intensive collection.³ One Mycenaean-style obsidian projectile point from this site provides the only evidence on the surface for the Late Bronze Age in the Diros survey zone.

Much of the Final Neolithic material was difficult to assign to vessel types, in large part because of the small size and poor preservation of the material. Nevertheless

we often could distinguish between larger and smaller vessels, and between open and closed, as well as identify features such as handles. Traces of red slip, burnishing, and relief bands (*‘taenia’*), all common on vessels from Alepotrypa, were identified on many sherds. Overall, the material from Site 2 seems to be contemporary with that from Alepotrypa. Further study of the Site 2 material may identify functional differences between the uses of the interior of Alepotrypa Cave and the open-air headland of Ksagounaki Promontory.

Site 3: Pano Katozikia and Tracts 170–172 (139 items total)

The only other prehistoric site identified in the Diros survey zone is Site 3/Tracts 170–172. In addition to material of the Final Neolithic, there is also some material of Early Bronze Age date, including a substantial piece of the T-rim of a large Early Helladic II pithos, one of the few items from the survey specifically dated to that phase of the Early Bronze Age. There also is a small presence of later material, perhaps some Classical–Hellenistic and definitely some Medieval.

The area of Site 3 is the third largest on the Diros Survey, but the quantity of material is one of the smallest (other than the special case of Site 7, below). Only seven pieces of obsidian were recovered from both collection types, a very sparse amount. Several pieces of different pithoi and other large containers of the Final Neolithic–Early Bronze Age were identified. Conspicuously lacking is tableware of the Early Bronze Age, but this could well be due to the exposure of this site, leaving it with little soil to preserve ceramic materials, as well as to later disturbances. Very few of the sherds preserve any surface treatment, and few vessel shapes could be assigned, in contrast to the collection at Site 2: Ksagounaki.

Site 4: Kampinaria and Tracts 53–64 (2,135 items total)

Site 4 is the largest area of intensive collection in the survey, and the quantity of material from the grid squares and Tracts 53–64 is also the largest, representing nearly 40% of all material recovered by the Diros survey. Site 4 lies on the northern side of a *remma*, just a short distance inland from the rocky shore. Though not included in our collection from Site 4, additional material was found south of the *remma*, such as in Tract 47. The site is primarily of Classical–Hellenistic date, though some Late Roman was recognised in the western portion of the site adjacent to the shore. Late Roman and Medieval material was found along the eastern portion of the site, where the modern road provides an artificial boundary between Sites 4 and 6, the latter of which has more Roman–Medieval material, found around the ruins of Ag. Theodoroi. It is unclear how continuous the occupation might have been, both chronologically and spatially, from the Classical through the Medieval period at these two sites.

The plentiful Classical–Hellenistic material seems to be concentrated towards the centre of Site 4, as well as in the south-eastern portion around the church of Ag. Paraskevi, just west of the road and Site 6, though some is found in nearly every grid square. Overall, material that can be dated specifically to the Classical–Hellenistic period represents about 21% of the total; nearly 55% of the total material, however, can be dated only to ‘Ancient Historic’, but there is a high probability that the majority of this material dates to the Classical–Hellenistic period. The range of shapes and fabrics of the Classical–Hellenistic from Site 4 is interesting, as it includes a large quantity of tableware shapes and fabrics; and over half of the ceramics are of fine or semi-fine fabrics of the Classical–Hellenistic or more broadly Ancient Historic period. Notably absent from the Classical–Hellenistic materials are kitchen wares (c. 0.5%), lamps (only one was identified), and loom weights (none were identified). In addition to the large quantities of fine and semi-fine wares, there is a significant quantity of storage wares, including amphorae (2.5%), pithoi (1.1%), and coarse wares (7.3%) of the Classical–Hellenistic and Ancient Historic period. This assemblage of a restricted range of pottery types from the Classical–Hellenistic period does not seem to indicate domestic use, but may perhaps indicate part-time occupation and temporary storage for transshipment of goods from maritime trade to the interior. The well-known polis of Pyrrichos is located directly up the *remma* that ends at the Bay of Diros, and Site 4 would make a good location for facilities connected with maritime trade to provision that town.

The Late Roman material includes a wide range of fabrics and types, including amphorae, one piece of Eastern Sigillata fine ware, kitchen wares, and bricks and tiles, suggesting small scale domestic activity. The concentrations along the western edge near the sea and along the eastern edge of Site 4 might indicate two separate establishments. Medieval material was found primarily in the eastern portion of Site 4, adjacent to the road dividing it from Site 6 to the east. Some Early Modern material was found throughout the site, without any definite concentration.

Site 5: Mastakaria and Tracts 117–119 (481 items total)

The range of vessels and other ceramic items, including amphorae, kitchen ware, fine/table ware, roof tiles, and even a fragment of a ceramic beehive, indicates domestic occupation and production. The majority of the material appears to be Roman–Late Roman in date, with some Classical–Hellenistic material and a few pieces of Medieval, including the Ottoman/Venetian period. Prehistoric material was completely lacking. When artefacts are plotted by their collection unit, it is clear that there is spatial separation of the Medieval material to the south-west of the site, in Square 15, from the Roman

material to the east, around the structure in Square 2. The high density of Roman material in Square 17 at the edge of the cliff is probably due to erosion of materials from the units just upslope. The Classical–Hellenistic material is spread throughout the units, perhaps indicating that it may derive from higher up the slope. This portion of our survey zone is a narrow strip along the cliffs of the north coast of the bay, and we were not permitted to examine the slopes above or further to the west.

There is a high density of tile around the structure encompassed by Square 2, and much of the other material comes from large vessels, including jugs and amphorae. Tiles represent 25% of the material from both the tract and intensive collections (121 tiles out of 481 artefacts). Several sherds of Late Roman Type 2 amphorae, two of Spirally Grooved ware, and one from a Group N (Agora) pitcher provide some of the more precisely dated material, to the 4th–6th or 7th centuries AD. There is relatively little semi-fine or fine ware represented in the assemblage.

Site 6: Ag. Theodoroi and Tract 82 (578 items total)

Site 6 is rather small, but has a high density of material dating to the Classical–Hellenistic, Roman–Late Roman, and Medieval periods. The Classical–Hellenistic material is found mostly along the western edge of the site, in the yard south of Ag. Theodoroi (Squares 1–4) and along the road that divides it from Site 4 with its concentration of Classical–Hellenistic material in the eastern portion, as well as east of the field wall to the south of the church (Squares 6 and 7). Roman and Late Roman material is mostly from the southern half of the site, and Medieval material is in the northern half.

A large amount of tile was found throughout the site (c. 15% of the total artefacts), ranging from the Classical–Hellenistic painted Lakonian and Corinthian types to Medieval types, but with concentrations in Squares 6, 17, and 18. This distribution of tile contrasts with the concentrations of ceramics in Squares 1, 2, 4, 5, 7, 14, and 17. Materials of Classical–Hellenistic date mirror the restricted range of fabrics and shapes of Site 4: black-glazed (nine total) and other fine to semi-fine ware sherds are plentiful (180, or c. 31% of the total artefacts), as are amphorae, pithoi, and other large storage vessels. The range of materials dating to the Roman and Late Roman periods is perhaps less restricted than that of the Classical–Hellenistic, with some kitchen ware in addition to amphorae (including Late Roman 2 type), combed and spirally grooved wares, and tiles.

There seems to be a correlation of Medieval material with the ruins of a second structure – identified tentatively as the remains of an old monastery – in Squares 12–14 and 17–18. The quantity of Medieval material is much less than that of the Roman period, and consists mostly of tiles, some coarse ware sherds, and portions of several small amphorae or jars. Two unusual finds from Square

18 include a roof tile cut down to circular form to serve as a stopper to an amphora or jar, and part of the rolled base to a blown glass goblet or cup that dates perhaps to the 6th century AD or later.

Sites 4 and 6 should be considered together when discussing densities of material, chronology, and function. The Classical–Hellenistic material is more widely spread throughout Sites 4 and 6, though with concentrations in the middle of Site 4 and straddling the road that divides Site 4 from 6. Late Roman material is found at the western edge of Site 4, near the beach, as well as straddling the road south of the ruined church of Ag. Theodoroi. Further study of the material from these two sites may refine our picture of the diachronic shift in foci of exploitation of this area.

Site 7: Psiata and Tract 262 (10 items total; 5 mortar samples)

The ‘intensive’ collection of material at this site was limited to the yard in front of a house located there, in an attempt to collect some ceramic material that could be associated with the dates inscribed into the lintels of the structure. The tract walking collected very little material (one tile and one possible prehistoric sherd), and the collection from the yard of the house yielded mostly Early Modern material such as fragments of a Koroni pithos, local Grottaglie ware, and several different ‘yogurt pot’ sherds.

The history of settlement in the Diros Bay and future research

The results of our survey provide a glimpse into the history of settlement in the Diros region beyond the important Neolithic site of Alepotrypa Cave. Of particular interest is the presence of two open air Final Neolithic sites, Site 2: Ksagounaki adjacent to Alepotrypa, and Site 3: Pano Katozikia, located on the plateau above and to the west of the cave. Site 3, with its small quantity of Early Helladic material, provides the first evidence for the Early Bronze Age in the Diros region. But other than the lone Mycenaean projectile point from the surface of Site 2, the survey indicates a long gap until the Classical period, when Site 4 emerges just to the north of Alepotrypa. Site 4 and its contiguous neighbour, Site 6, seem to exist into the Early Medieval period, but the continuity of this occupation remains unclear. Site 5, also on the shore of Diros Bay and dating to the Roman period, might suggest a pattern of shifting settlement along the shore (but not too far), from Alepotrypa to Site 4, then to Site 5, and back to Site 6.

Several important research questions arise from the archaeological survey of the Diros Bay, and will help to focus our future research agenda. One such question is the lack of Neolithic and earlier material preceding the Final Neolithic period in the region, despite the long-lived nature of exploitation of Alepotrypa Cave (Pullen

2017). There are several well-documented sites in Mani and Lakonia that date to the Palaeolithic and Mesolithic periods, yet we found no clear evidence of chipped stone artefacts that date to these periods on the survey. Middle to Late Pleistocene sites in the region include Apidima, Lakonia and Melitzia, which are located in Oitylo Bay, just north of Diros, suggesting that the region was occupied intensively throughout the Pleistocene (*e.g.*, Harvati *et al.* 2003), but no artefacts from the Diros survey can be attributed to this time period.

This lacuna of evidence for habitation in Diros Bay continues throughout the Early and Middle Holocene until the Final Neolithic period. This is especially surprising given the substantial amount of Early, Middle, and Late Neolithic materials from inside Alepotrypa Cave. The lack of Late Neolithic material outside Alepotrypa Cave may be related to the general preference for cave exploitation in this period (Demoule and Perlès 1993; Vitelli 1999, 100), or the ‘low visibility’ of Late Neolithic ceramics in the landscape (Rutter 1983), but given the intensity of our tract walking and our subsequent intensive collections, especially at Sites 2 and 3, we expect that we would have identified pre-Final Neolithic material in the survey region.

Although Alepotrypa Cave, Site 2, and Site 3 indicate substantial habitation in the region at the end of the Neolithic and the beginning of the Bronze Age, this florescence of settlement seems to have been short-lived. Unlike many other coastal areas of Greece, which experienced an explosion of sites during the Early Helladic period, the survey data from Diros indicate that the region was all but abandoned until the Classical–Hellenistic period, when a settlement was established on the alluvial fan in the mouth of the bay.

The establishment of Sites 4 and 6 during the Classical–Hellenistic period marks the first substantial habitation of the survey area since the end of the Neolithic, but the relationship of these sites to the wider region remains unclear. For example, we still do not understand how these sites in Diros Bay related to other Classical–Hellenistic sites in the region, such as the dominant plateau town of Oitylo and its bay (with its own port facilities) immediately to the north of Diros, or to the inland town of Pyrrichos, which sits on one of the few traversable routes across the Mani that connect Diros Bay to Kotronas on the east coast. The trans-Mani route unites the Bay of Messenia with the Bay of Lakonia, and Site 4 in Diros Bay is well situated to take advantage of its location at the western end of the route. Occasional reports from the towns of Pyrgos Dirou and Charia of graves dating to the Classical period might also suggest a permanent settlement in the area, one which would have used Site 4 as its port. The modern fishermen from the town of Pyrgos Dirou currently use the bay in this manner.

Our survey zone extended up to the northern edge of the Medieval and Modern settlement of Pyrgos Dirou.

While we found some Medieval material in our survey zone (e.g., at Sites 5 and 6), only Site 7, which is just outside the urban fringe of Pyrgos Dirou, provides a coherent assemblage of material from the Early Modern period from our survey. The relationship of the coastal zone of Diros Bay with the settlements on the plateau along the western side of the Mani is the third major area of research interest. The extensive terracing, boundary walls and *kalderimia* indicate that the hillsides leading down to the sea were extensively exploited, but perhaps only by farmers moving out from their hilltop towns such as Pyrgos Dirou.

Our survey of Diros Bay indicates several broad temporal trends, which need to be fleshed out with additional research, including survey of other bays and upland regions along the western coast of Mani as well as through targeted excavations. The region is characterised by boom-and-bust demographic patterns, interspersed with long periods of abandonment or very limited exploitation and use. Given the restricted area we were permitted to survey, it remains unclear whether this pattern would change significantly if we were to extend our survey area to the upland plateau and into the passes that traverse Mani. Until other parts of the region are surveyed, it will remain unclear just how exceptional Diros Bay is compared to the other bays that stretch all the way around the Mani peninsula.

Based on our survey data, we can identify a definite demographic boom during the Final Neolithic period, with the establishment of the site on the Ksagounaki promontory. This site was an open-air extension of Alepotrypa Cave, which we now know was used intensively since the Early Neolithic period. The recent modification of the landscape in front of Alepotrypa Cave, where the museum and the road were later built, make the precise relationship between the sites of Ksagounaki and Alepotrypa difficult to ascertain, but the site of Ksagounaki seems to be associated directly with a florescence in the use and exploitation of Alepotrypa Cave. They are, in essence, different parts of the same site. Our continued work at Ksagounaki will focus on establishing more clearly how the two sites relate to each other, chronologically and socially. It is tempting to draw parallels to the contemporaneous site of the Franchthi Cave and its *paralia*, but such comparisons will need to await additional research at Ksagounaki.

After the end of the Neolithic and the beginning of the Bronze Age, the study area seems to have been largely abandoned until the Classical–Hellenistic period, when Sites 4 and 6 were established, most likely as part of a port. Although there is some Late Roman material from the study area (e.g., Site 5), the amount pales in comparison to that commonly found elsewhere. For example, in the eastern Korinthia, Late Roman material was found in almost every single survey tract (Tartaron *et al.* 2006). By contrast, Diros Bay was not extensively exploited until the Byzantine and Ottoman periods, when

the church and monastery complex were established in the 13th or 14th centuries AD. This initiated the next big demographic boom in the region, as the Mani became one of the most densely inhabited regions of Greece during the Ottoman period.

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Notes

- 1 Seifried studied the Byzantine- and Ottoman-period landscape of the Diros Project survey region for her dissertation research (Seifried 2016; see also Seifried 2015).
- 2 *Macquis* is defined here as a particular species of high thorny bush (*Calicotome villosa*), known locally as ‘ασπύλαθος’, and which we colloquially call the ‘living dead’.
- 3 Nearly 20% of the ceramics could not be identified to period.

Bibliography

- Cherry, J. F., Davis, J. L. and Mantzourani, E. (eds) (1991) *Landscape Archaeology as Long-term History: Northern Keos in the Cycladic Islands from Earliest Settlement until Modern Times*. (Monumenta Archaeologica 16). Los Angeles.
- Davis, J. L. (ed.) (2008) *Sandy Pylos: An Archaeological History from Nestor to Navarino*. Austin.
- Demoule, J.-P. and Perlès, C. (1993) The Greek Neolithic: A new review. *Journal of World Prehistory* 7, 355–416.
- Drandakes, N. V. (2009) *Μάνη και Λακωνία, επιμέλεια Χάρης Κωνσταντινίδου*. 2. Mani - Excavation and Research. (Λακωνικά Σπουδαί Supplement 17). Athens.
- Gregory, T. E. (2004) Less is better: The quality of ceramic evidence from archaeological survey and practical proposals

- for low-impact survey in a Mediterranean context. In E. F. Athanassopoulos and L. Wandsnider (eds) *Mediterranean Archaeological Landscapes: Current Issues*, 15–36. Philadelphia.
- Harvati, K., Panagopoulou, E. and Karkanas, P. (2003) First Neanderthal remains from Greece: The evidence from Lakonis. *Journal of Human Evolution* 45, 465–473.
- Pullen, D. J. (2017) Caves and the landscape of Late Neolithic – Early Helladic I Greece: Comparing excavation and survey data from the Peloponnese. In S. Dietz, F. Mavridis, Z. Tankosic and T. Takaoğlu (eds) *Communities in Transition: The Circum-Aegean Area in the 5th and 4th Millennia BC*. Oxford.
- Rutter, J. B. (1983) Some thoughts on the analysis of ceramic data generated by site surveys. In D. R. Keller and D. W. Rupp (eds) *Archaeological Survey in the Mediterranean Area*. (British Archaeological Report S155), 137–142. Oxford.
- Seifried, R. M. (2015) The shifting tides of empires: Using GIS to contextualize population change within the landscape of seventeenth to nineteenth-century Mani, Greece. *International Journal of Historical Archaeology* 19, 46–75.
- Seifried, R. M. (2016) *Community Organization and Imperial Expansion in a Rural Landscape: The Mani Peninsula, Greece (AD 1000–1821)*. Unpublished PhD dissertation, University of Illinois at Chicago.
- Tartaron, T. F., Gregory, T. E., Pullen, D. J., Noller, J. S., Rothaus, R. M., Rife, J. L., Diacopoulos, L., Schon, R., Caraher, W. R., Pettegrew, D. K. and Nakassis, D. (2006) The Eastern Korinthia archaeological survey: integrated methods for a dynamic landscape. *Hesperia* 75, 453–523.
- Vitelli, K. D. (1999) *Franchthi Neolithic Pottery*, Vol. 2: *The Later Neolithic Ceramic Phases 3 to 5*. (Excavations at Franchthi Cave, Greece fasc. 10). Bloomington.

An integrated assessment of Alepotrypa Cave

Anastasia Papathanasiou

Alepotrypa Cave was investigated by G. Papathanassopoulos from 1970 to 2006. It was used from the end of the Early Neolithic to the Final Neolithic Period, from c. 6,000 to 3,200 cal BC. During almost 40 years of excavation, a significant number of activity areas and features were exposed in the interior of the cave, and enormous amounts of cultural artefacts and deposits were accumulated. Despite its great potential to illuminate an important prehistoric site and crucial formative period in human history, this material remained very little studied. From 2012 to 2014, with primary support from the Levy Foundation, the present project sought to rearrange, study in detail, and publish the massive quantity of material originating from the cave. The first aim was to define securely the chronological, stratigraphic, and typological range and sequence of the undisturbed cultural deposits of the cave; second, to conduct a truly multidisciplinary and interdisciplinary program of research; third, to clarify the character of Alepotrypa and to reconstruct as far as possible the past life, economic activities, social organisation, and ritual expression of those utilising the cave; and finally, to incorporate this site into its prehistoric background in Greece, the Aegean, and Southeast Europe. In this final summary chapter, an initial examination, cross reading, and integration of the resultant body of data is presented, which will surely change and develop with future research conducted after this volume is published; it aims to define the character and role of this specific site, as well as to identify long-term patterns of stability and change for prehistoric societies in Greece.

It is important to open the discussion with a summary of what we thought we knew, to set forth the accepted interpretation of Alepotrypa (up to 2011), as it had been shaped through the material published up to that point. This was a mixed picture (correct in places, but also partly inaccurate) that even now many of the contributing

authors in this volume repeat in the introductory part of their chapters: often they restate and challenge this received knowledge, or parts of it, depending on the extent to which their data contradicts it. According to this historical interpretation (Papathanassopoulos 1996, 2011), Alepotrypa was inhabited only during the Late and Final Neolithic, from c. 5,000 to 3,000 cal BC. It was strongly oriented towards the sea, situated on a maritime route for the obsidian trade between the southern Peloponnese and the island of Melos. People were also attracted to the potable water in the lakes inside the cave. An earthquake sealed its entrance and the people who had survived the earthquake were trapped inside the cave and died of starvation. The prehistoric people of Diros conducted their agricultural activities outside Alepotrypa Cave, but lived inside permanently or more likely periodically. A series of domestic tasks were believed to have been carried out inside, as deduced from the implements and tools for such tasks that were found inside the cave, including weaving, sewing, grinding grain, cooking, tool making and basketry. They had organised the space throughout the entire length of the cave into niches for families, and they had significant storage facilities in clay-lined pits and in large pithoid vessels. According to the published accounts, a ruling elite may have existed, as implied by the existence of prestige goods (Papathanassopoulos 1996, 2011). They buried their dead in a variety of ways: next to the habitation zones or in ossuaries in dedicated areas, which were used exclusively and repeatedly for this purpose, exhibiting possible familial relationships. Their health was moderate and their diet was agricultural; marine resources were consumed, but not to a significant degree (Papathanasiou 2000, 2001, 2005).

While certain parts of this narrative have been verified and reinforced by recent analyses, other aspects do not conform to the data, if they ever did, and indeed some have been completely disproved. An aim of this volume, then,

was to clarify, to cross-check, and to present the verified information that has resulted from the detailed scientific observation of the material – and only then to proceed with great caution to further interpretations.

The most striking and rewarding aspect of this project was that the independent work of each researcher was attuned to the work of the others, contributed to, or helped verify existing data and corroborated lines of evidence, all of which lead to the forging of compatible interpretations, mutually reinforcing each other. In this way the final picture that emerges is very tightly linked and cross-checked with evidence. All the researchers observed and recognised similar overarching patterning in the materials they studied and came up with similar questions and concerns. This concord, I believe, is the greatest contribution this volume makes to archaeological research in general. It demonstrates in the best possible way the benefits of a thorough multidisciplinary and interdisciplinary study of an archaeological site and how such research can lead to far more informed interpretations and a deeper and more nuanced understanding of the past. Where possible, it also pulls together the detailed scientific observation of the material to tease out past social and symbolic actions, and to provide a multidimensional picture of a Neolithic community.

A major contribution of this project is the revision of the chronological range of Alepotrypa Cave's use and the definition of the stratigraphic sequence of the cultural material. Through a very ambitious, detailed, and systematic program of absolute (radiocarbon) dating from 27 samples of human and animal bone and charcoal, Alepotrypa is now the best dated Neolithic site in Greece (see, in particular, chapters by Papathanasiou and Karkanas). Radiocarbon dating identifies the first human presence in the cave at approximately 6,000 cal BC. This date was verified in three different locations and expands the range of use of the cave by a millennium, to the end of the Early Neolithic period. The revised chronology now accommodates the appearance of early pottery styles in the stratigraphy (chapters by Katsipanou, Psimogiannou, and Katsarou). The microstratigraphic study conducted by Karkanas, in correlation with the radiocarbon dates and the study of old field notebooks, defined the cultural horizons in the vertical stratigraphy of the cave and their sequence, which in turn were correlated with the ceramic seriation (Katsipanou in Trench B1, Psimogiannou in Chamber Z, and Katsarou in Ossuaries I and II), thus creating a well-documented, secure, tool for inter-site comparisons in Neolithic Greece and the Balkans.

The second major contribution by this project is that most researchers observed, recognised and described a distinct differential spatial distribution and patterning of the materials they studied throughout the different locations inside the cave. The results converge. Their combination implies a division of the cave into at least two broad areas: the anterior, closest to the entrance and

mainly involving Chambers A and B and possibly parts of D (also comprising the most excavated and investigated parts of the cave); and the interior, towards the back of the cave and mainly Chamber Z, which was investigated in more detail after 1990. The two zones exhibit different characteristics as a result of their differential use in the past, as all the studies observe. The difficulty arises as to how to interpret the observed and documented patterning. Such interpretation is an important goal, but it is not straightforward or self-evident. Many contributors to this volume make efforts when they recognise and identify an elaborate ritualistic component then to define the distinct and characteristic elements that comprised it, as well as elucidate how these elements can be differentiated from others that are characterised as being more 'domestic' or 'mundane'. Questions constantly arise as to what might differentiate domestic versus ritual behaviours and how the one merges or is transformed into the other. Importantly, throughout this volume one can follow how the archaeologist's broader vision influences his or her description, wording, and the final interpretation of a context, and how difficult it remains to define differential uses of space and their characteristics.

The spatial differentiation of Alepotrypa Cave

It is primarily the pottery (see Psimogiannou, this volume) that differentiates the interior part of the cave (Chamber Z), from the anterior part (Chambers A, B and D), even though the ceramic assemblages exhibit many typological similarities. Nonetheless, when analysed, the ceramic assemblages from the two areas differ distinctly: the assemblage from Chamber Z consists mostly of painted vessels of closed shapes, which comprise the majority of all the painted pottery in the cave. Stylistically, both the painted and the monochrome wares here represent the same types found in the anterior part of the cave and in the same chronological sequence, but in the interior the vessels are much better preserved, if even used at all, and they are more complete, although very broken, and more abundant.

The black burnt matter that comprises the majority of the sediment in the interior Chamber Z is burnt animal dung (see Karkanas, Tsartsidou, this volume), which is almost exclusively present in Chamber Z and only very rarely shows up in other parts of the cave. In contrast, in the anterior chambers clean wood, branches, grasses and twigs were used for fuel: they imply more short-term episodes of burning, not repetitive ones, and activities indicative of small-scale cooking and minor, if any, cereal processing in the cave (see Margaritis, Tsartsidou, this volume).

The analysis of wood charcoal macro-remains (see Ntinou, this volume) also demonstrates that the anterior part of the cave is characterised by short-term depositional contexts, such as single episode hearths. The firewood that

was used there was collected from the open vegetation outside the cave. The interior chambers involving the use of fire employed as their main fuels dung and twigs, which were lighter and easier to carry, perhaps dictated by the inaccessibility of these chambers. Also, the interior chambers are characterised by the exclusive and constant presence of the rare black pine, *Pinus nigra*, which was apparently imported from some distance, and most probably was used to provide light (perhaps as torches), due to its high resin content.

The deposits themselves (see Karkanis, this volume) from the front chambers consist of constructed clay surfaces and occupational debris; the latter is composed of burnt remains and food discards, and is caused by the frequent reorganisation of space leading to an intensive reordering of the deposits. This may suggest the existence of intensive domestic activities in this part of the cave. In contrast, the deposits in the interior chambers of the cave are quite different: they are characterised by extensive and relatively thick dung-rich deposits created by smouldering fires, often associated with built clay floors and rich in archaeological materials and human bone remains.

Differential spatial distribution is also observed in the macrolithics, the so-called ground stone tools, although Stroulia (this volume) argues that the high concentration of specimens in Chamber B represent some kind of archaeological construct. Furthermore, the striking majority of the chipped stone tools (see Kourtessi-Philippakis, this volume) comes from Chamber B, whilst Chamber Z yields a special assemblage, where tools, such as retouched blades and notches, are dominant and present at an exceptionally high rate. They include some of the most sophisticated chipped stone tools, exclusively of obsidian, and some have no traces of use (in this regard they resemble similar observations made of the pottery).

The faunal analysis (see Hadjikoumis, this volume) also points to some minor differentiation of Chamber Z, in its near-absence of cattle, but a stronger predominance of sheep, and in the lower overall species diversity and little evidence of gnawing and burning. The marine faunal material is more distinctive. Theodoropoulou (this volume) observes the raw consumption of molluscs, after crushing, as occurring primarily in Chamber B, as well as whole fish remains from communal consumption. She stresses the special depositional character of the site in general, and especially in Chamber D, where a unique assemblage points to the deposition of selected slices or fillets of the best fish found in the cave, in association with the secondary burials. In contrast, although Chamber Z yielded a low number of shell and fish remains, it produced the bulk of the grouper found in the cave. Additionally, in the anterior chamber she observes the exclusive presence of cone shells, which might have had special medicinal uses.

Through the petrographic analysis of the ceramic fabrics (see Pentedeka, this volume), it is further suggested that Chamber Z seems to be characterised by ritualistic and specialised consumption, while the anterior chambers present more diversity.

Finally, in terms of mortuary evidence (Papathanasiou, this volume, Chapter 13), intentional primary burials, as well as formal ossuaries, are observed only in the anterior parts of the cave, while Chamber Z is typified by scattered bone and, to date, at least one case of the secondary deposition of two children.

Chamber Z, which represents the excavated part of the interior of the cave, has been added only very recently to the narrative discussions of Alepotrypa Cave; it was excavated between 2000 and 2006. It is described and analysed in detail in this volume by Psimogiannou. The anterior parts of the cave, namely Chambers A and B and the front part of Chamber D, were the focus of most of the past archaeological campaigns. Accordingly, all the relevant publications tended to project the interpretation given to these chambers onto the entire cave. However, as mentioned above, there is ample evidence now to suggest that the two zones – back and front, although used in parallel – show distinct and essential differences in their cultural material, formation, organisation, and context.

Chambers A, B, and possibly D, are the closest to the entrance and so more accessible. These are characterised by coarse, open, ceramic vessels, small and large, which are usually in very fragmentary condition and extremely well-used, repaired, and sometimes even worn to exhaustion. These areas also are characterised by extended clay floors, pits, hearths, primary and secondary burials, lithic tools, short-term fires (where the fuel is of tree branches, twigs and grasses). They indicate no intensive agricultural activities, nor do they display any possibility for large-scale storage, implying the use of this area as a ‘short-term’ living space; rather, the people of Alepotrypa must have occupied the areas outside the cave, as indicated by the work of Pullen *et al.* (this volume).

Chamber Z, in the interior of the cave, immediately before the large Chamber of Lakes, constitutes a far less accessible area, one characterised by massive concentrations of intentionally broken and dispersed ceramics, including well-preserved, closed shapes, and both fine painted and monochrome wares. These ceramics probably had seen very little use, and frequently can be completely reconstructed from their small broken fragments. This, as well as the human bone scatter, a single secondary burial, a significantly small number of often unused but sophisticated tools, ornaments, and massive amounts of repeatedly burnt animal dung, all imply a more ritualistic setting. None of the hearths in Chamber Z shows a domestic character, but they do indicate careful maintenance.

To summarise, there is evidence from Alepotrypa for two different modes of space use and for different

contextual associations of the cave's rich assemblages with different use-areas. Two conclusions can be suggested with confidence: first, the Neolithic occupants simultaneously carried out different projects in different places; and two, they maintained similar practices at the same locations throughout the two millennia of use, showing impressive repetition, persistence, stability, and continuity in their choices, systems, and cultural expressions. Alepotrypa constitutes a multi-functional and multi-temporal terrain. The next problem to be faced, then, is to define and explain these findings: What is the purpose of the differential deposition of artefacts in specific contexts? What are the distinct characteristics that differentiate the two parts of the cave, anterior and interior? What was the overall character and the meaning of this site for its Neolithic inhabitants? How, and for what, was the cave used?

Permanent vs seasonal and domestic vs ritual use of the cave

Initial interpretations of Greek Neolithic caves characterised them as domestic because of the household objects that were found in them, and later caves were viewed as places for seasonal pastoral activities; in due course some scholars have argued that caves might have been places of intentional and/or ritual deposition – places where people were leaving specific items, thereby taking them out of circulation (Nakou 1995, 6–7; Broodbank 2000, 165). In addition, the role of caves as places for social and/or ritual gatherings was stressed (Vitelli 1993, 1999; Stratouli 2005), specifically as special locations, or 'arenas,' where people gathered for particular occasions and short-term visits, making themselves visible to others by using distinctive pottery and artefacts. (Vitelli 1999, 100–102, 2007, 115–116). The domestic model of the habitation of caves in the prehistoric Aegean also has been questioned by Tomkins (2009), who pointed out that there is no clear boundary between the ritual and the quotidian. He stressed the importance of Neolithic caves as 'ritual and central places for interaction and exchange, regional or supra-regional arenas for consumption, negotiation of status and identities' (Tomkins 2009, 138, 146). Consequently, a critical issue raised by the study of the cultural material from Alepotrypa Cave concerns the particular nature of this site and how it was used. Part of this concerns the question of permanence or seasonality of occupation and/or the ritual use of the cave.

Interwoven with the notion of habitation is the notion of storage, especially for Alepotrypa, where numerous vessels of substantial size, as well as clay-lined pits, were found, as described by Valvis (this volume). However, most of the researchers agree that it is difficult to imagine that crops would survive long-term storage, due to the excessive humidity of the cave. Sprouting of grains and germination have been recorded in caves in southern France due to this factor (as noted by Margaritis, this volume). Furthermore,

no concentration of archaeobotanical material has been found in any place in the cave. Stroulia agrees that the cave was unsuitable for storage: foodstuffs, like grain, meat or fish, would not last long in the extremely humid cave conditions. That said, according to Papayianni and Cucci (this volume) the presence of the wild steppe mouse could imply possible storage of grain in the cave, but this need not have been on any massive scale. In general, evidence for storage of dry goods is lacking. Storage of liquids needs to be further investigated. Food might instead have been stored at nearby open-air sites, such as Ksagounaki, identified and documented by Pullen *et al.* (this volume).

Regarding seasonality, the faunal evidence (*e.g.*, sheep/goat mortality patterns and material culture; see Hadjikoumis, this volume) points towards year-round use of the cave by humans, with seasonal aggregations. He offers the following interpretation regarding seasonality: The analysis of the assemblage indicates that the yearly cycle of pastoral activities was uneven with a period of intense activity, roughly from early winter until late summer. This seasonally increased demand for labour, combined with the concomitant increased availability of meat and milk constitute strong incentives for a seasonal congregation of more people at Alepotrypa. The exact reasons and context of such seasonal activities cannot be clarified only based on faunal remains. Nevertheless, it can be speculated that this potential for seasonal consumption of animal protein by extended groups was fulfilled, independent of the specific context in which it took place (*e.g.*, religious, social, economic, or a combination of those).

Theodoropoulou similarly suggests year-long cycles of collecting and fishing activities, possibly intensified during the summer, while Tsartsidou also identifies possible winter and spring/summer episodes of use.

Although the cave may have been used throughout the year, evidence for intensive habitation inside the cave is not supported by any of the results of the majority of the researchers in this volume. A more periodic use of a less 'domestic' character is better supported by the existing evidence. Specifically, Tsartsidou and Margaritis (this volume) conclude that large-scale processing of crops was not conducted inside the cave, unlike what one might expect from an open-air site. The hearths indicate short-term episodes and not prolonged domestic use, but they do also show careful maintenance, as Tsartsidou, Karkanis and Ntinou suggest. Also, though the finished products of tools, pots, and personal decoration are found in the cave, the by-products and debris of the manufacturing process are rarely recovered (see Stroulia, Kourtessi-Philippakis, Stratouli, this volume), with the exception of some half-finished shell ornaments (Theodoropoulou, this volume). In fact, the numbers of stone and bone tools/artefacts are proportionally very low compared to open-air sites (Kourtessi-Philippakis, Stratouli, this volume). Lastly, there is no evidence to support the idea of the cave as

a place where people discarded their garbage: many of those objects retrieved from the cave are unused. On the other hand, there is evidence that the cave was repeatedly used for well-structured mortuary rituals (chapters by Papathanasiou, Katsarou, Psimogiannou, this volume).

Having examined the data and determined what the cave was not – *i.e.*, a permanent home to large numbers of people – one may argue, based on the available data, for:

- a) small-scale use, but with no clear ‘domestic’ character, associated mostly with the anterior part of the cave;
- b) careful management and maintenance of the space;
- c) deliberate and structured deposition of certain objects, in a specific and enduring manner, including fragmentation, dispersal, and commingling, pertaining mostly to the interior part of the cave;
- d) parallel, repetitive use with specific areas dedicated to different actions through time; and
- e) a multistage mortuary ritual.

Thus, management of the cave by a modest-sized population and for the performance of certain rituals is better supported by the evidence. That population likely lived outside the cave, but in its vicinity, as indicated by the results of regional surface survey (Pullen *et al.*, this volume).

Accordingly, the main impediment to this interpretation is the term ‘domestic’ itself, loaded as it is with a series of cultural connotations (household, family, production). It should be avoided or redefined, and certainly used with caution. The same is true for the terms habitation and/or inhabitant of the cave (and in fact of any cave, in general). A less rigid and more inclusive interpretation of the terms ‘domestic’ or ‘habitation’ would be constructive: one that included any kind of temporary use and maintenance of a cave by any human group. Alepotrypa Cave was definitively *used* by prehistoric people. It contains pots, tools, ornaments, food refuse, hearths, structures – the full spectrum of household and prestige goods. It also contains a variety of human burials and served as a venue for various rituals. At the same time it does not exhibit any evidence of processing, either related to tool manufacture or food production. These must have taken place outside the cave proper.

So, in the course of decontextualising the previous narrative and further deciphering the assemblage and the character/role of Alepotrypa, one may state that the evidence does not support an exclusively domestic reading of the entire cave, but rather a mixed one, possibly ritually oriented. Naturally, one must always keep in mind the fluid boundaries of the two terms, domestic/ritual, how they may overlap, and that they are not mutually exclusive terms or concepts. An explanation that may better accommodate all the data presented would identify Alepotrypa as a place for social gatherings, drawing on populations from the local and broader region, with very well defined and long-lasting schedules and programs which were performed individually at very specific places

in the cave and following very specific rituals, some for as long as two millennia. Characteristics common to all the activities were the fragmentation, commingling, and dispersal of the cave’s material culture, be it bones, pottery or plant remains and its deposition in a very structured and visible way (see chapters by Papathanasiou, Psimogiannou, Katsarou, Tsartsidou, Karkanas, this volume).

The inner part of the cave was devoted to rituals/ ceremonies involving primarily ceramics that were excellently manufactured and/or intensely decorated, possibly used for pouring purposes, as well as exquisite examples of tools or personal ornaments, scattered bone, and most distinctively, the repetitive burning or smouldering of animal dung. The anterior part of the cave was devoted more to the deposition of human burials, either primary interments or, most frequently, secondary burials, and exhausted pottery and tools. Food deposition or sharing could have taken place in both the front and back portions of the cave system, but certainly it is more characteristic of the anterior part of the cave – either in the form of the large-size vessels and the open pottery forms or in the quantity of faunal remains. What is also impressive in the anterior part of the cave is the construction and subsequent careful repair, maintenance, or rebuilding of extended clay floors/platforms, (see also Karkanas, this volume) which can be described as highly demanding communal work in terms of labour, power, and raw material expenditure. Such structures are suitable not so much for everyday use, but more as a ceremonial setting.

Within this framework, it is possible to suggest a form of ‘domestic’ use for the anterior part of the cave, connected both with seasonal gatherings and with long-term maintenance and management of the site. Persistence of certain activities for two millennia, such as pottery recipes, stone tool manufacturing techniques, exploitation of the same obsidian resources, intensive butchering activities, all probably imply the presence of a persistent and permanent local population, characterised by conservative traditions, perhaps of modest numbers (as indicated by survey, Pullen *et al.*, this volume). They likely inhabited the surrounding region on a year-round basis and perhaps exercised control in maintaining the cave as a place of communal significance for seasonal gatherings, occurring probably around summer. These gatherings may be associated with a more ritual pattern of depositional practice witnessed at Alepotrypa, with the symbolic manipulation of matter. Immense quantities of material were accumulated on a periodic basis, over a long time, during which they were vested with singular meaning.

With the present data, the emerging picture of Alepotrypa suggests that for two millennia the cave was subject to a tradition, organised according to careful protocols, of the intentional deposition of ‘items’ – be they human burials or pottery and tools. This patterned behaviour included

deliberate fragmentation, dispersal/scatter, commingling, deposition, display, and accumulation, all probably connected with mortuary practices and gatherings. These performances span the two millennia of the cave's use. Some may have been executed simultaneously, but each one of them was carried out in a different location inside the cave that was devoted to the specific activity in question, sometimes for very long periods of time.

What was the exact purpose of these gatherings and rituals? What was the geographic distance/range of its influence? These questions cannot be answered at this time. However, additional evidence comes into play here, derived from the recent, unpublished excavations at an open-air site, called Ksagounaki, just outside the cave (see discussion in Pullen *et al.*, this volume). Three Neolithic double burials topped by a well-built Mycenaean ossuary (c. 1,300–1,200 BC) were recovered at Ksagounaki, suggesting that Alepotrypa remained a place of remembrance for centuries after its collapse. It was consistently associated with rituals and burials, including frequently massive quantities of commingled remains. Additionally, data from Giblin's (this volume) preliminary analysis of strontium variability in human and animal bones suggests that at least a few individuals from the Alepotrypa assemblage may have a very distant geographic origin. Two dimensions stand out in the interpretation of Alepotrypa Cave: that of the notion of fragmentation was a key theme of the rituals, and that of it being a place for communal gatherings. Both endure down through the centuries and millennia.

The theme of manipulation of material, bodies, and pottery (fragmentation, removal, recombination, substitution, and reintegration) is a regular social practice in past societies. Prehistory, history, and ethnography provide a wide range of examples, showing that fragmentation is a deliberate, meaningful act where body- or object-parts stand metonymically for whole bodies or cultural entities. They remain symbolically linked even when physically separated. A fragmented part bears a distinct meaning through its enchainment relationship to the whole; it represents the whole, albeit in different contexts, and it acquires new significance as proof of ancestry and inheritance (Rebay-Salisbury *et al.* 2010; Chapman 2010). Regarding the burials themselves, intact human skeletons are not a common archaeological feature, as a burial can be just one or two bones or everything from a primary, secondary, or even tertiary context, which can serve to tie communities to their ancestral past and to create invisible links in time and space (Stodder 2005, 249). In general, the complexity of interment and other mortuary procedures and their importance within social, political and economic contexts in the interpretation of past societies has been of perennial interest (Rakita and Buikstra 2005).

Manipulation through practices of fragmentation and deposition of human body/pottery 'parts and wholes' at Alepotrypa recalls similar cases in Greece from other

caves such as Franchthi (Cullen 1985, 1999; Jacobsen 1973a, b), and also open sites such as the 'special deposit' on Keros island (Renfrew *et al.* 2013). This further strengthens the case of a pervasive form of intentional fragmentation and accumulation, emphasising collective solidarity, social membership, remembrance, continuity, and, most importantly, enchainment of people and places in time and space. A whole series of parallel cases of ritual centres in the Mesolithic, Neolithic, and Chalcolithic periods of the Near East and Europe are known, of varying magnitude and character. Starting with the obvious, megalithic, monumental, ones at Gobekli Tepe, Malta, or Stonehenge (Schmidt 2012; Chapman 1995; Whittle 1996) down to the smaller, but more ritualistic ones, occasionally associated with fragmented and commingled human remains, such as Çatalhöyük, Hacilar, Çayönü Tepesi, Yarım tepe II, Varna, Zengővárkony, Lepenski Vir IIIb, and Hungarian and Bulgarian tumuli (Mellaart 1961, 1967, 1970a, 1970b; Özdoğan 1999; Croucher 2010; Chapman 2010).

In the interpretive framework proposed, Alepotrypa acts like a repository of many materials, animals, plants, and people – both dead and alive. The cave, with its liminal character, separates them from the landscape and the world outside, transforming the domestic/mundane item into a symbolic one, by its deposition in a non-mundane context. These two worlds, although naturally and symbolically distinct, are materially not that different. As such they challenge us to reconsider possible arbitrary dichotomies between the mundane, the utilitarian, and the domestic, on the one hand, and the ritual or the sacred, on the other hand (Margaritis, Stroulia, Katsarou, Psimogiannou, this volume). The structured deposition and manipulation of all kinds of materials, including their fragmentation and accumulation, indicate a form of ritual behaviour that draws upon and transforms the domestic into symbols in order to enchain people and places. Ritual can thus be seen as a different way of experiencing the domestic (Tomkins 2009; and Psimogiannou this volume).

Economic practices

Other aspects that were elucidated by the research in this volume are the economic activities of production, consumption, manufacture and trade that were carried out in Alepotrypa Cave. Diet is a part of any society's engagement in cultural networks, and culture may determine food choices, at times more than does availability, nutritional value, or even the taste of the food. The results of dietary reconstruction, presented by Papathanasiou in Chapter 13, associate the people of Alepotrypa with an agricultural economy and a subsistence strategy focused primarily on plants, probably domesticated, and to a lesser degree on animals, with only the occasional exploitation of the near-shore marine protein resources. Consequently, it is inferred that the cultural significance

and value of domesticates was crucial and that farming was the major economic activity, followed by animal husbandry, and complemented by occasional hunting or fishing of wild species. The crop repertoire of the cave is presented by Margaritis: it includes 15 different species of cereals, pulses, fruit trees and wild species (einkorn emmer, einkorn wheat, spelt, free threshing wheat, hulled barley, grass pea, vetch/vetchling, common pea, lentil, almond, fig, and wild weed). However, both Margaritis and Tsartsidou agree that there is no evidence to suggest any large-scale processing of cereals inside the cave. Crop processing most likely was carried out outside the cave, in the surrounding vicinity and only the by-products were subsequently used as fuel in the cave.

Animal husbandry, as shown by Hadjikoumis (this volume), was a more important economic activity than hunting as the overwhelming majority of domestic animals, which accounts for 90–95% of the faunal assemblage, shows. Hunting was performed at Alepotrypa, but played, at least economically, a marginal role. The hunted species include red deer, wild pig, hare, and wild carnivores (fox, badger, marten, cat and possibly jackal). The most important species, economically, were sheep and goat, which account for 60–80% of each sample, which is amongst the highest of any Neolithic site in mainland Greece. The pig constituted a secondary (to sheep/goat) source of meat, with percentages consistently in the 15–20% range, while cattle numbers were consistently low. Evidence for the exploitation of animals implies milking, even during the early phases of occupation, meat production, with possibly wool/hair collection. Entire animal carcasses were processed and consumed at Alepotrypa. There is evidence for skinning, dismembering and filleting of almost all the identified species. Cooking of meat was primarily done in pots, ovens or pits, and less so on open fires.

In terms of the marine-resources exploitation, Theodoropoulou (this volume) identifies a wide spectrum of shell and fish sampled. However, the shells are largely dominated by limpets and topshells, with topshells slightly increasing and limpets slightly decreasing from the Late to the Final Neolithic. Both taxa show a considerable size decrease, possibly due to the overharvesting of the larger individuals during the Late Neolithic. Murex shells, dove shells, and cone shells are also quite important. Fish remains are primarily represented by Scombrids (mainly bluefin tuna and albacore tuna), which make up 46% of the total, followed by groupers and sparids. In the Final Neolithic, diversity increases but the relative importance of Scombrids decreases in favour of the two other groups, groupers and sharks/rays, although all three remain consistently the dominant groups, together with sea bream and mullet. In terms of preparation and consumption, whole fish were brought into the site and indications of butchering allow one to suggest the cooking of large tuna chunks, either in large pots or in ovens. Tuna-slicing and

caudal tuna preservation also are suggested. There are indications of raw and boiled consumption of the marine molluscan foodstuffs, accompanied by a high level of intentional crushing. Overall, the marine remains imply a more communal participation in the acquisition and consumption of important quantities of freshly-caught invertebrates and in particular the larger fish, which were probably not reserved for further, or at least long-term, preservation.

The necessary firewood for all the activities inside the cave, as indicated by Ntinou (this volume), was systematically collected from the late EN to the FN from the diversity of the local environment. The collectors in time widened their range to include evergreen woodlands and deciduous thickets, probably as a response to higher demand. The role of recycled dung as fuel, especially that of stabled sheep, was also prevalent in the interior regions of the cave.

Technological continuity is indicated in both chipped and ground stone tool manufacturing, as well as in pottery: it too thus reflects the stability of the social systems. Stroulia states that ‘those who procured and used the macrolithic raw materials belonged to different generations of the same group that followed similar rules for many centuries’, while from the results of the petrographic analysis of the cave’s pottery, Pentedeka suggests that pottery is ‘characterised by compositional homogeneity and constancy in execution through time, possibly implying very specific production and consumption practices highly resistant to changes.’ Technological continuity and sophistication is also observed by Kourtessi-Philippakis in the obsidian tools, which indicate a predominantly laminar industry with subsequent transformation into tools by retouching. Only the final stages of the reduction sequence of obsidian and the various flints have been documented in the cave, in contrast to the grey flint which was knapped more locally. Stratouli also mentions the increased demands over time in technical knowledge and skills in the manufacturing of the bone tools. Repair and exhaustion is evident in a large number of stone and bone tools alike.

Evidence for systematic trade comes from the obsidian tools. Kourtessi-Philippakis (this volume) confirms the existence of a clearly defined supply network of obsidian in the form of preformed cores, especially in the Late and Final Neolithic, when obsidian vastly outnumbers local flints, the latter being perhaps more dominant in the Early Neolithic. Riebe (this volume) suggests that all of the obsidian likely originated from two quarries at Melos. The Sta Nychia quarry accounts for 73.95%, while Demenegaki represents 26.05% of the entire assemblage, implying possible reorganisation of obsidian procurement, and a lack of specialised control. Other imported items include the black pine wood, the Black and Grey Burnished pottery, certain stone used for ground tools, metals, and perhaps the *Spondylus* shell.

In summary, the economic data point to an agro-pastoral community with heavy emphasis on a few taxa of domesticated plants and animals. This is a common picture of the Neolithic economy, as the Neolithic lifestyle became a stable cultural attractor, dictating economic and social choices and actions. In that framework, the stability provided by agricultural production was highly esteemed and preferred. Pastoralism followed suit, but domesticated animals were expensive to raise and keep, were considered as economic capital, and so were consumed infrequently, usually on special occasions, either being shared or sold/exchanged within a community. Wild resources from hunting or fishing contributed to a much lower degree, perhaps regulated by other criteria, such as nutrition, gastronomy, symbolism, or prestige. Very importantly, all the subsistence activities (agricultural and pastoral schedules, fishing, shell collecting, firewood procurement, raw materials used for tools and ornaments, and traded items) strongly indicate extensive knowledge of the broader environment and the ability to ensure its profitable management and maximum exploitation, though extending at times into overharvesting and exhaustion of resources.

Environmental reconstruction

Ample information can be retrieved from a number of papers here on the climate and the environmental setting around Alepotrypa during the Neolithic. At 6,200 BC, as Boyd and Holmgren suggest, a cold and dry period began that persisted for approximately 150 ± 200 years, starting around the time of the first appearance of people at Alepotrypa Cave. When thermohaline circulation resumed, the climate became slightly more moist and warm, but with a gradual decrease of humidity and increased arid conditions until around 3,000 BC, which coincides with the end of human presence in the cave.

The faunal evidence implies an almost rocky and barren environment, although there are indications for more forest coverage and sandier coves. In agreement with the previous study, there is also tentative evidence for either increased aridity or reduced forest coverage, or both, towards the end of the Neolithic period, reflected in a decrease in forest-loving species in favour of sheep and goat (Hadjikoumis, this volume). A rocky, steep environment is also suggested by the microfauna (Papayianni, this volume).

The wood charcoal remains from Alepotrypa Cave (Ntinou, this volume) indicate that deciduous oak and evergreen or mixed woodland extended even to these southernmost parts of the Peloponnese. This would have been the natural vegetation of the area, until at least the end of the Neolithic period. Open scrub vegetation was also characteristic of the area, probably confined to the steeper and stonier ground and which during the Neolithic might have also expanded onto cleared land. The evergreen woodland was rich in taxa among which *Phillyrea* would

have been the predominant, followed by the evergreen oak. In the open vegetation around the cave, various *Prunus* species grew relatively densely in the earlier phases, forming the tree level among a rich undergrowth dominated by shrubs of the pulse family and to a lesser degree by shrubs of the mint family. Through time, the abundance of shrubs increased, while the tree level decreased, as they were the closest to the site and the most frequent source of fuel. Increased aridity and increased population may have other parameters responsible for their decline. Finally, Theodoropoulou provides evidence for the presence and harvesting of an estuarine environment of brackish water, probably close to the cave while Papayianni and Cucci suggest that the presence of the steppe mouse could imply small mammal commensalism around the cave.

Conclusion

As Whittle (1996, 8) states, ‘if part of the process of becoming Neolithic was participation in new forms of social interaction, another part was a changing sense of belonging, of descent, and of place in the scheme of things’.

A long lineage, stable and enduring, marks the rituals expressed in the material culture of Alepotrypa Cave; it is reflected in the fragmentation, dispersal and structured accumulation of all artefacts, including pottery, tools, plant, shell, fish, and animal remains, dung and clay floors, as well as human depositions. The intensity of the ceremonial elaboration and the repetition of the symbolic actions of the community/ies using the cave and performing these rituals for two millennia, consciously and meaningfully, suggest the persistence of the memory and the significance of this place through social relations, probably in connection with formalised mortuary performances through time. Simultaneously, indications exist that a local community, possibly living in the surrounding area, characterised by an agricultural economy and conservative in its production and manufacture methods, was maintaining and possibly controlling the cave, at least during the Final Neolithic.

The cave thus probably constitutes a lasting focal point in a ritual and social landscape, a mortuary monument for the locality or a broader area, exercised through a remarkably monumental program of worship and by repeated acts of deposition. The site most probably performs, in varying and complex ways, an important role in the Neolithic of southern Greece, as a place of congregation for different social groups, reaching the highest point sometime in summer, where the memory of the past was revived and was invested with ritual and ancestral importance for the living, a place of remembrance and enchainment both across current space and through deep time. As Psimogiannou states in this volume:

Fundamentally, the important attribute of Chamber Z and Alepotrypa Cave is that, despite some discontinuities in the use of space, be they longer or shorter, there appears

to be an intriguing continuity in the expression of human activities, since the same practices are repeated down through the years. Such continuity and conservatism argues for a strong connection and commitment to the place, between the people of the past and the people of the present. It was a social arena where there occurred an on-going dialogue between the living, the dead and the ancestors, and at the same time among the living themselves (Helms 1998), conducted through continuous episodes of deposition, through a series of departures and returns to this cave.

This volume, as stated in the introduction, presents the biography of Alepotrypa Cave, contributes a robust, new, chronology and clarifies the cultural and environmental framework of the site and the era. It brings this significant site, one of the most important Neolithic sites in Europe, to the attention of the archaeological community, after more than 40 years of excavations. It does so by combining archaeological science and observation with socio-anthropological interpretation, by integrating interdisciplinary analyses concerning the production, circulation, and consumption of the various kinds of materials excavated in the cave, and considering ritual intensification, memorialisation and past social actions and systems. It contributes to a better understanding not only of the character of the cave's use, but also of the symbolic world and the social practices of Neolithic people, and identifies long-term tendencies in the data to establish a comprehensive picture of human social behaviour and adaptation in prehistory, which continue to resonate and shape our perceptions and actions today.

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Bibliography

- Broodbank, C. (2000) *An Island Archaeology of the Early Cyclades*. Cambridge.
- Chapman, J. (2010) 'Deviant' burials in the Neolithic and Chalcolithic of Central and South Eastern Europe. In K. Rebay-Salisbury, M. L. S. Sørensen and J. Hughes (eds) *Body Parts and Bodies Whole: Changing Relations and Meanings*, 30–45. Oxford.
- Chapman, R. (1995) Ten years after – megaliths, mortuary practices, and the territorial model. In L. A. Beck (ed.) *Regional Approaches to Mortuary Analysis*, 29–51. New York.
- Croucher, K. (2010) Bodies in pieces in the Neolithic Near East. In K. Rebay-Salisbury, M. L. S. Sørensen and J. Hughes (eds) *Body Parts and Bodies Whole: Changing Relations and Meaning*, 6–19. Oxford.
- Cullen, T. (1985) Social implications of ceramic style in the Neolithic Peloponnese. In W. D. Kingery (ed.) *Ancient Technology to Modern Science. Ceramics and Civilization*, 77–100. Columbus.
- Cullen, T. (1999) Scattered human bones at Franchthi cave: remnants of ritual or refuse? In P. P. Betancourt, V. Karageorghis, R. Laffineur and W.-D. Niemeier (eds) *Meletemata, Studies in Aegean Archaeology Presented to Malcolm H. Wiener as He Enters his 65th year*, 165–171. (Aegeum 20). Liège and Austin.
- Helms, M. W. (1998) *Access to Origins. Affines, Ancestors and Aristocrats*. Austin.
- Jacobsen, T. W. (1973a) Excavation in the Franchthi Cave, 1969–1971, pt I. *Hesperia* 42, 45–88.
- Jacobsen, T. W. (1973b) Excavation in the Franchthi Cave, 1969–1971, pt II. *Hesperia* 42, 253–283.
- Mellaart, J. (1961) Excavations at Hacilar, fourth preliminary report, 1960. *Anatolian Studies* 11, 39–75.
- Mellaart, J. (1967) *Çatal Höyük: A Neolithic Town in Anatolia*. London.
- Mellaart, J. (1970a) *Hacilar 1*. Edinburgh.
- Mellaart, J. (1970b) *Hacilar 2*. Edinburgh.
- Nakou, G. (1995) The cutting edge: a new look at early Aegean metallurgy. *Journal of Mediterranean Archaeology* 8, 1–32.
- Özdoğan, A. (1999) Çayönü. In M. Özdoğan and N. Başgelen (eds) *Neolithic in Turkey: The Cradle of Civilization. New Discoveries*, 35–63. Istanbul.
- Papathanasiou, A. (2001) *A Bioarchaeological Analysis of Neolithic Alepotrypa Cave, Greece*. (British Archaeological Report S961). Oxford.
- Papathanasiou, A. (2005) Health status of the Neolithic population of Alepotrypa cave, Greece. *American Journal of Physical Anthropology* 126, 377–390.
- Papathanasiou, A., Larsen, C. S. and Norr, L. (2000) Bioarchaeological inferences from a Neolithic ossuary from Alepotrypa cave, Diros, Greece. *International Journal of Osteoarchaeology* 10, 210–228.
- Papathanassopoulos, G. A. (1996) *Neolithic Culture in Greece*. Athens.
- Papathanassopoulos, G. A. (2011) *To Neolithikó Διρό*. Athens.
- Rakita, G. F. M., and Buikstra, J. E. (2005) Introduction. In G. F. M. Rakita, J. E. Buikstra, L. A. Beck and S. R. Williams *Interacting with the Dead: Perspectives on Mortuary Archaeology for the New Millennium*, 1–11. Gainesville.
- Rebay-Salisbury, K., Sørensen, M. L. S. and Hughes, J. (2010) Body parts and bodies whole: introduction. In K. Rebay-Salisbury, M. L. S. Sørensen and J. Hughes (eds) *Body Parts and Bodies Whole: Changing Relations and Meaning*, 1–5. Oxford.
- Renfrew, C., Philaniotou, O., Brodie, N., Gavalas, G., and Boyd, M. J. (2013) *The Settlement at Dhaskalio. (The Sanctuary*

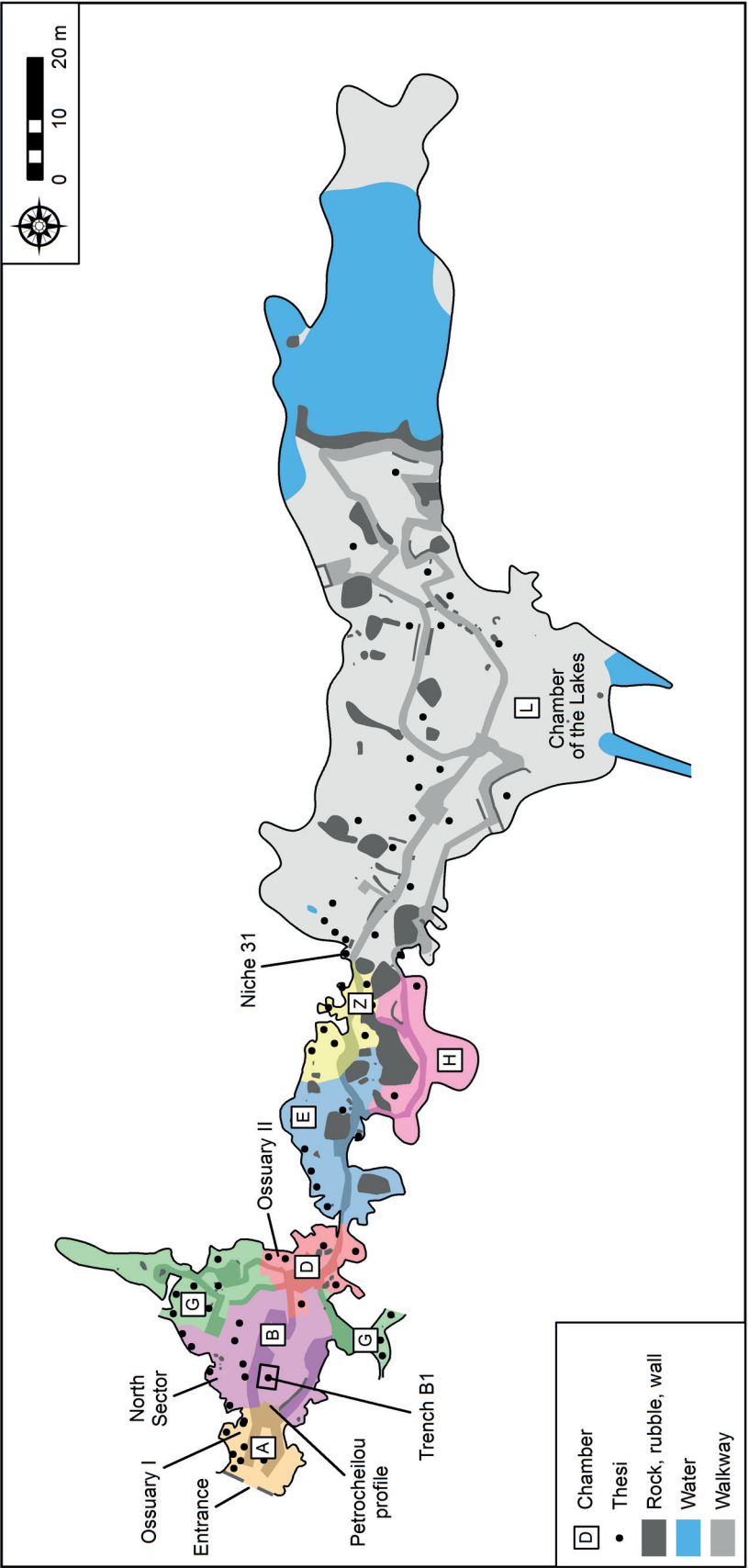
- on Keros and the Origins of Aegean Ritual Practice: the Excavations of 2006–2008), I. Cambridge.
- Schmidt, K. (2012) *Gobekli Tepe: a Stone-age sanctuary in South-Eastern Anatolia*. (Translation of 2007 publication). Munich.
- Stodder, A. (2005) The Bioarchaeology and Taphonomy of Mortuary Ritual on the Sepik Coast, Papua, New Guinea. In G. F. M. Rakita, J. E. Buikstra, L. A. Beck and S. R. Williams *Interacting with the Dead: Perspectives on mortuary archaeology for the New Millenium*, 228–250. Gainesville.
- Stratouli, G. (2005) Symbolic behavior at places of social activity beyond the domestic area in the Ionian Neolithic. *Documenta Praehistorica* 32, 123–132.
- Tomkins, P. (2009) Domesticity by default. Ritual, ritualization and cave-use in the Neolithic Aegean. *Oxford Journal of Archaeology* 28, 125–153.
- Vitelli, K. D. (1993) *Franchthi Neolithic Pottery, 1: Classification and Ceramic Phases 1 and 2*. (Excavations at Franchthi cave, Greece: fasc. 8). Bloomington.
- Vitelli, K. D. (1999) *Franchthi Neolithic Pottery, 2: The Later Neolithic Ceramic Phases 3 to 5* (Excavations at Franchthi cave, Greece: fasc. 10). Bloomington.
- Vitelli, K. D. (2007) *Lerna. A Preclassical Site in the Argolid, V. The Neolithic Pottery from Lerna*. Princeton.
- Whittle, A. (1996) *Europe in the Neolithic*. Cambridge.



CPI 1. Overview of Diros Bay (by Rebecca Seifried).



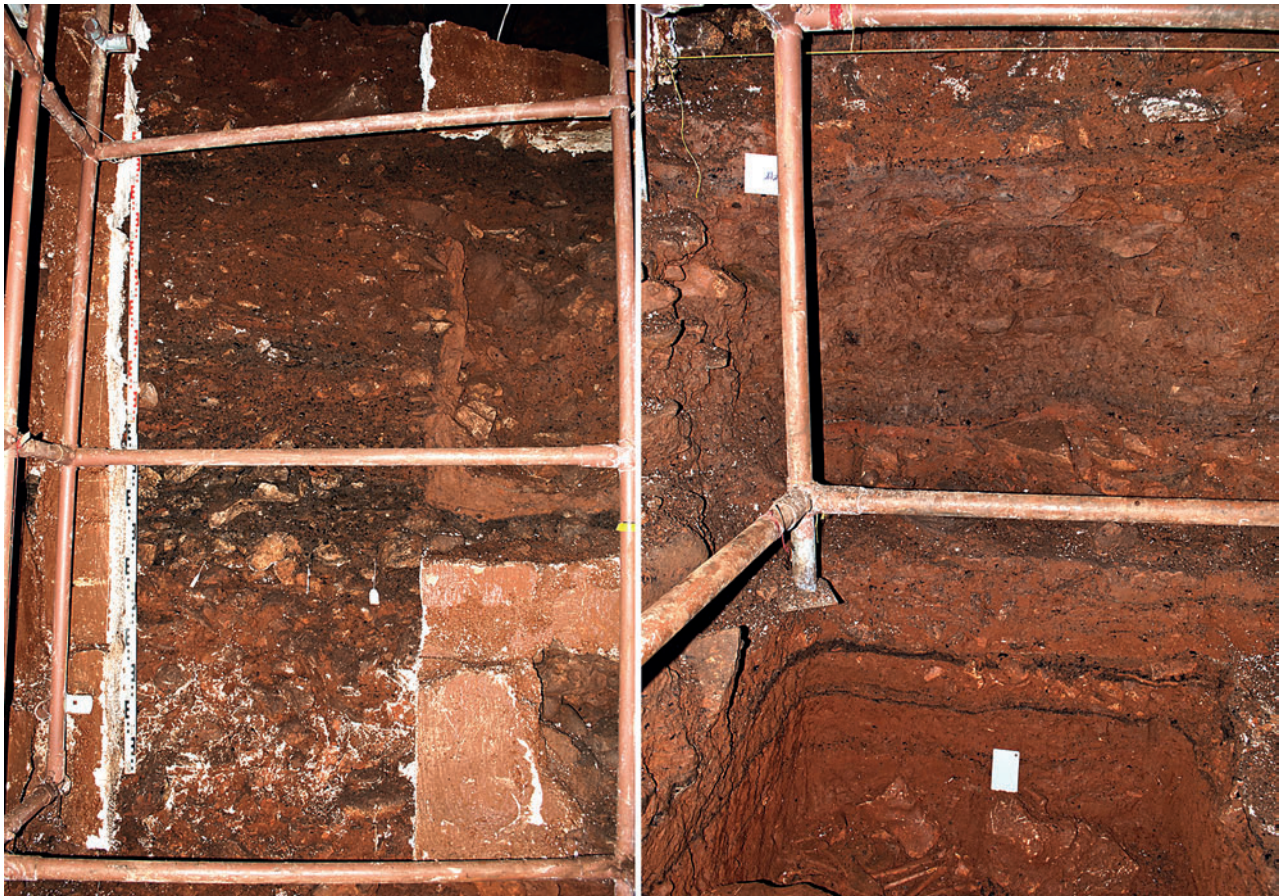
CPI 2. Diros Bay (by Rebecca Seifried).



CPI 3. Map of the chambers of Alepotrypa Cave (by Rebecca Seifried).



CPI 4. Alepotrypa Cave, Petrocheilou profile (by Panagiotis Karkanas).



CPI 5. Alepotrypa Cave, Trench B1 west and south profiles (by Panagiotis Karkanas).



CPI 6. Alepotrypa Cave, overview of Chamber B with Trench B1 (looking west to Chamber A and the entrance) (by Andreas Dalras).



CPI 7. Alepotrypa Cave, North Sector (by Panagiotis Karkanis).



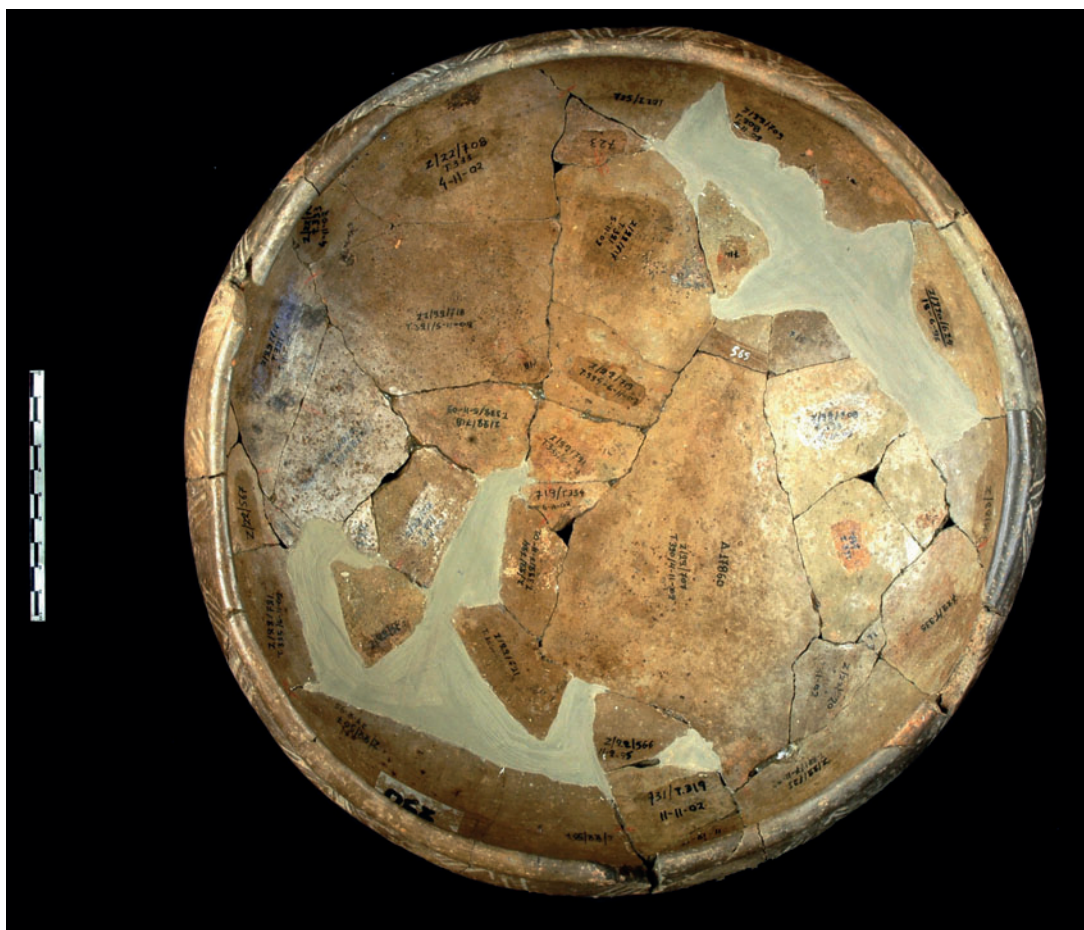
CPI 8. Alepotrypa Cave, overview of the Chamber of Lakes (looking east towards the lake) (by Andreas Darlas).



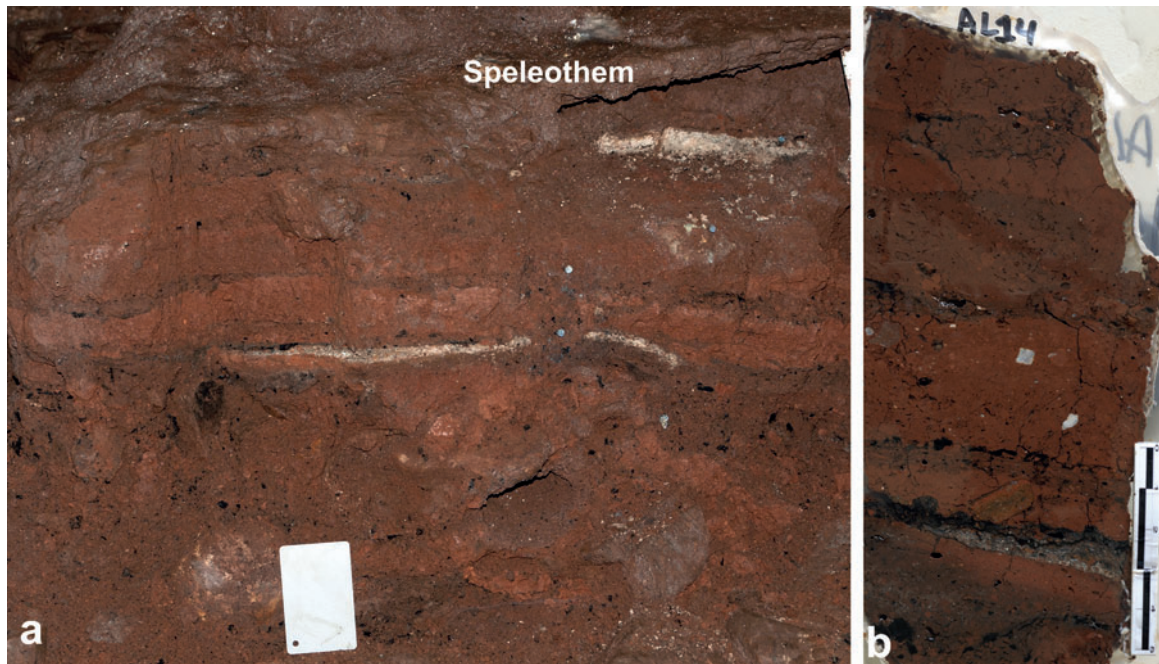
CPI 9. Alepotrypa Cave, overview of the Chamber of Lakes (looking east towards the lake) (by Panagiotis Karkanas).



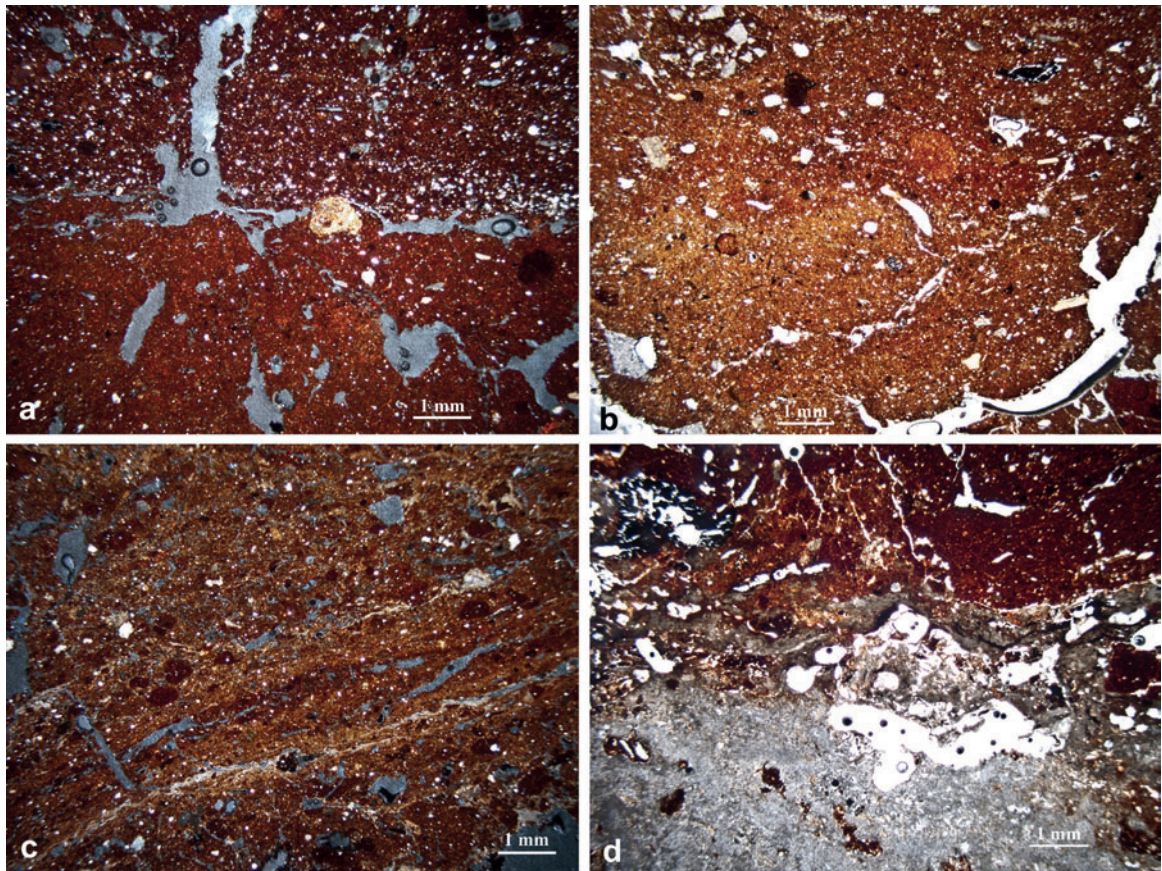
CPI 10. Alepotrypa Cave, the Lake (by Andreas Darlas).



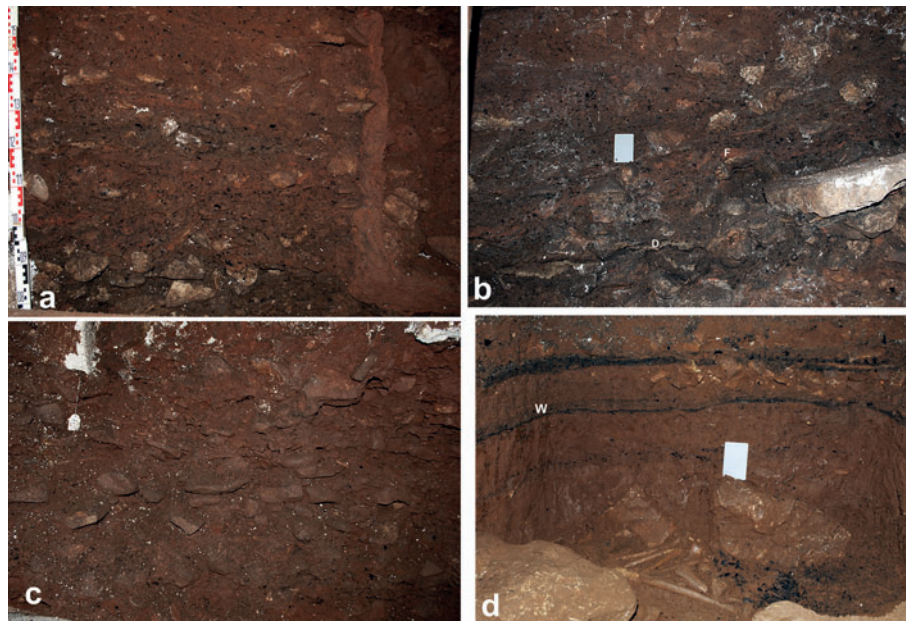
CPI 11. Example of the recording system of the finds from Alepotrypa Cave (by Andreas Heliakopoulos).



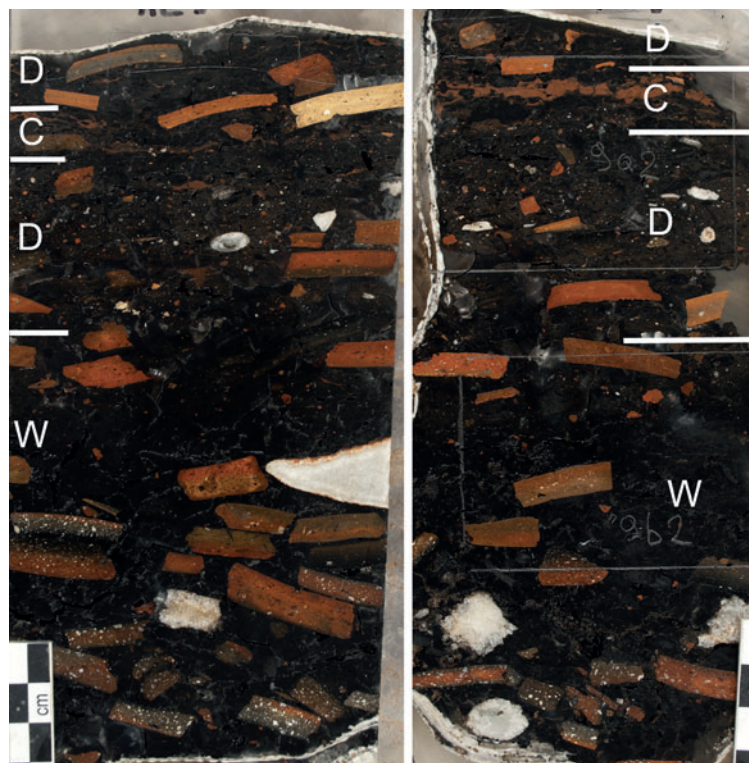
CPI 12. Area B2–B5. a): sequence of constructed red clay floors with intercalated white ash layers capped with a flowstone (speleothem). b): resin-impregnated slab of the same sequence, showing a more detailed picture of the clay floors and the gray hearth remains between them.



CPI 13. a) photomicrograph of the contact between two floors with contrasting clay composition (in crossed polarised light, XPL); b) photomicrograph of a calcareous clay floor overlaid by a decalcified one (in plane polarised light, PPL); c) thin replastering layers in between floors (XPL); d) in situ wood grey ash remains overlain by red clay floor. Note the stingers of round vesicles and a generally deformed contact between the two constructing materials (PPL).

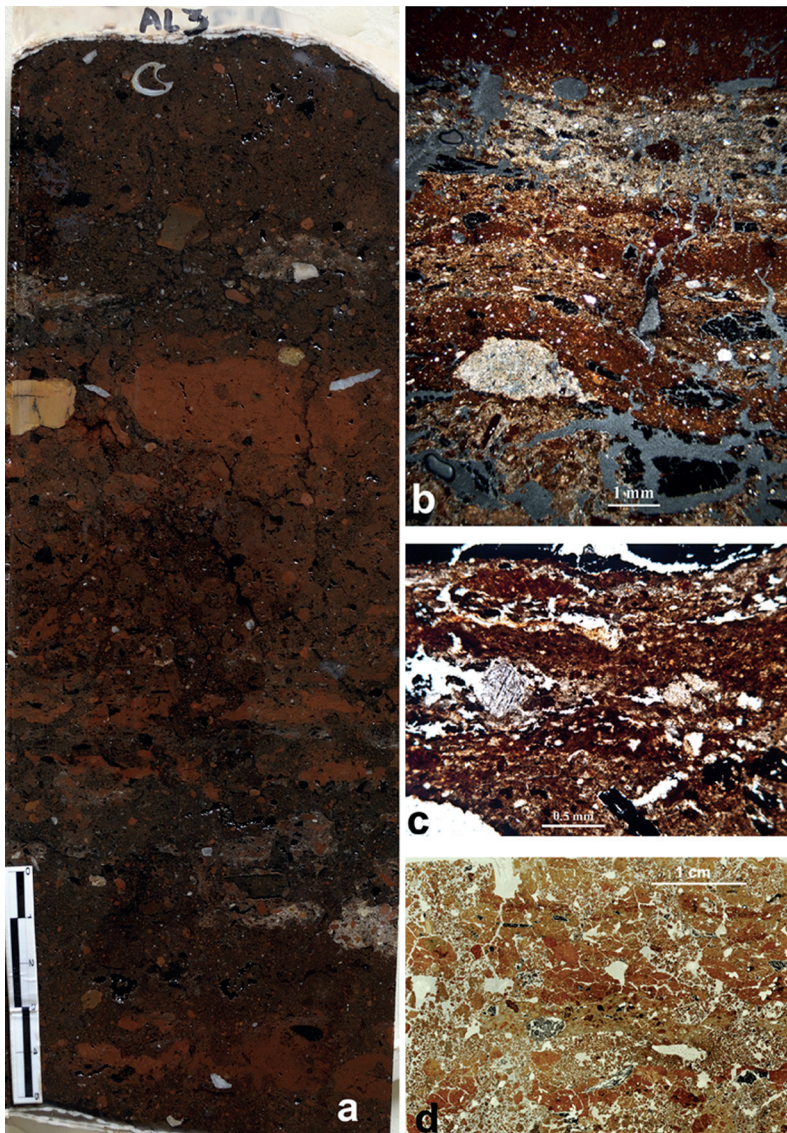
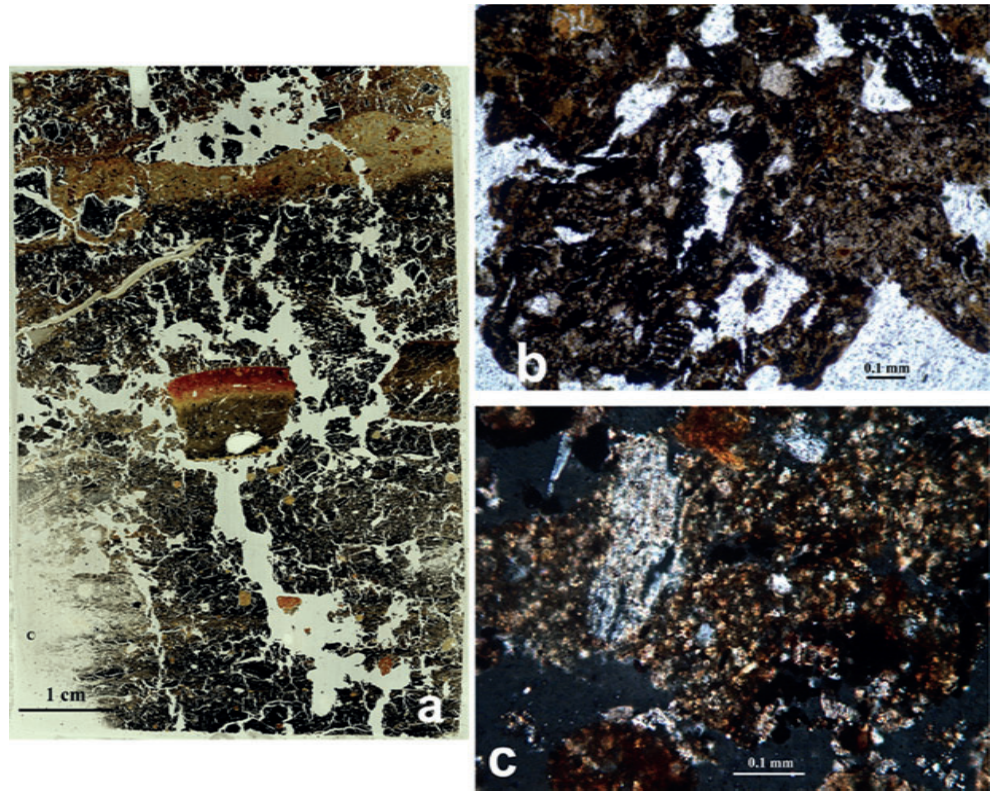


CPI 14. a) crudely bedded anthropogenic deposits with intercalated fragments of red clay constructions. Part of a clay-lined pit is shown in the right part of the image; b) a thin dark grey to olive green lens of burnt dung remains (D) in between mixtures of dark burnt remains and stones, all capped by a surface of red clay floor remnants (F); c) stone layer composed of relatively flat, small pebble-sized stones; d). image of the lower burial associated with a stone structure and burnt remains overlain by red deposits and intercalated thin horizons rich in black burnt remains. Note the fine laminated and sorted appearance of the middle burnt horizon (W) attributed to water flow disturbance.

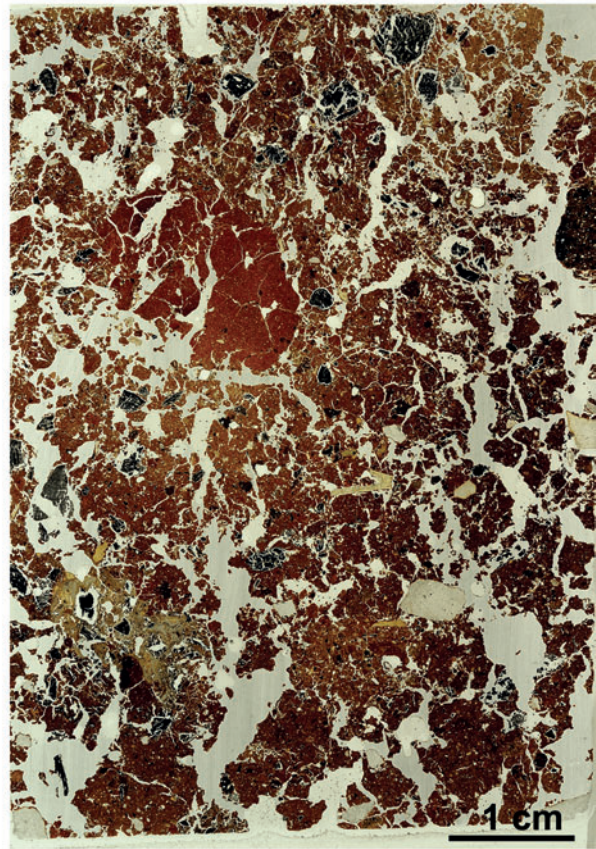
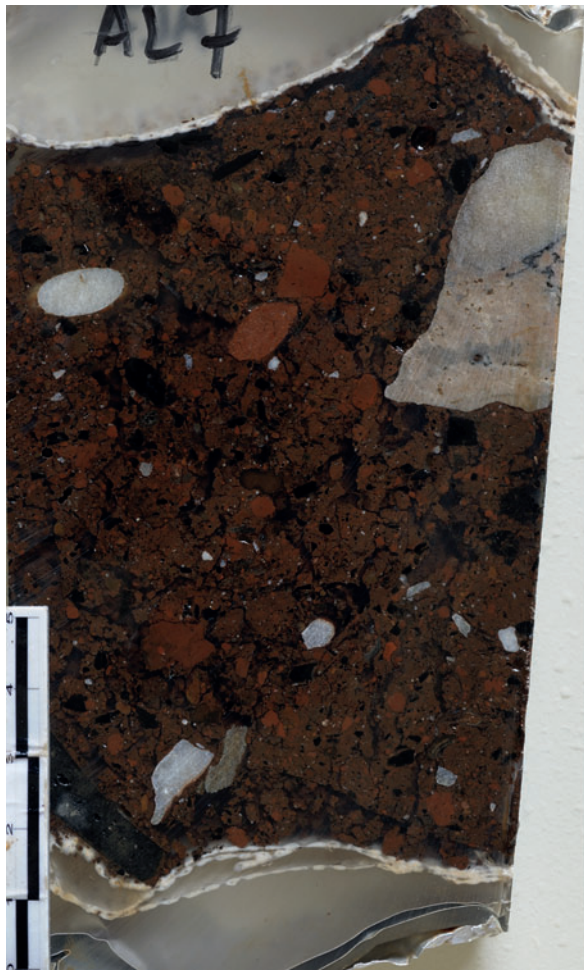


CPI 15. Resin impregnated slabs coming from the same sample from Chamber Z, showing discrete layers of wood branch charcoals (W), burnt dung (D) and remnants of a disturbed red clay floor (C).

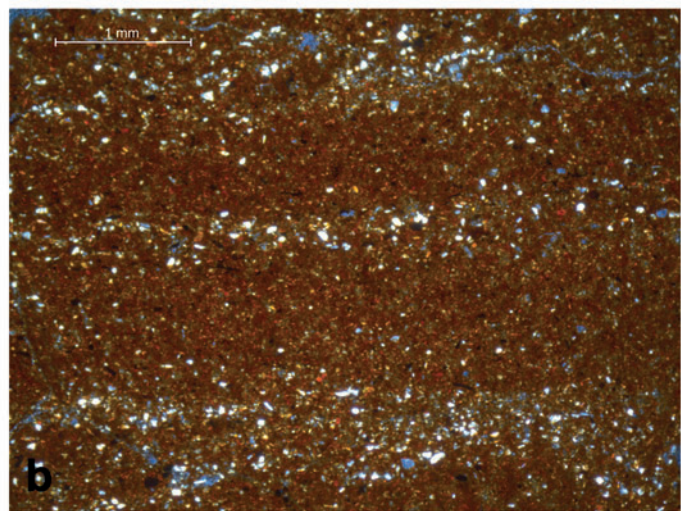
CPI 16. Micromorphological sample from area Θ (Th) 14. Left: thin section scan, showing mainly black burnt dung remains capped by a thin grey wood ash layer. Note the two charcoal pieces in the left lower part of the ash layer and the gradual contact to the underlying burnt dung remains. Right: b) detail of fragment of a burnt dung pellet with convolute structure and vughy porosity and c) image of fine dung spherulites with the characteristic dark cross under crossed polarised light (XPL).



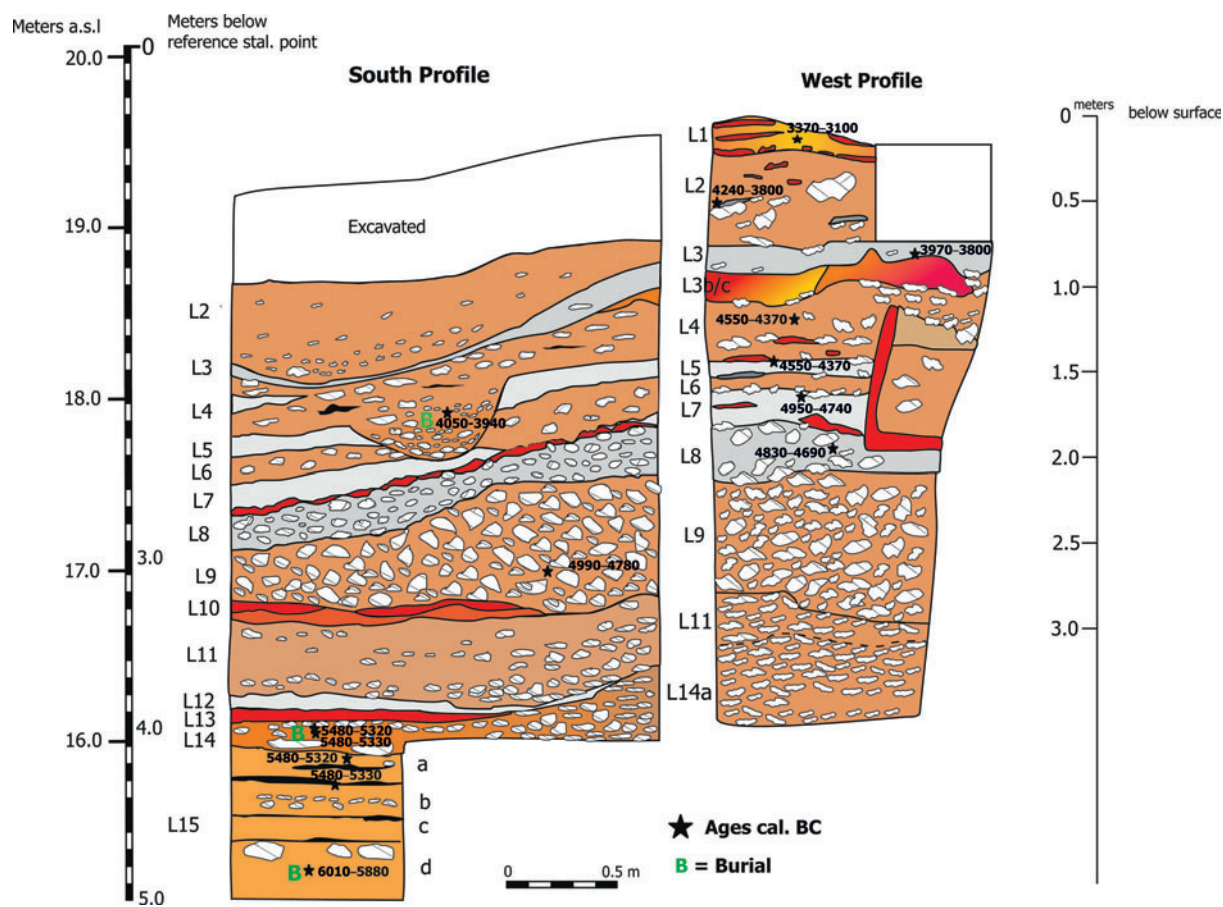
CPI 17. Resin-impregnated slab (left) and photomicrographs (right) of stratified anthropogenic remains of facies D, showing repeating alternation of stringers of clay floor remnants defining discrete surfaces and intercalated burnt remains.



CPI 18. Resin-impregnated slab (left) and scan (right) of thin section of chaotic mixture anthropogenic remains of facies E.



CPI 19. Scan of thin section (left) and photomicrograph (PPL) of water-lain deposits (right). Note the fine lamination and sorting of the sediment in latter.



CPI 20. Stratigraphical sections of Trench B1, showing the location of micromorphological samples (black boxes) and radiocarbon dates (see Table 2.1 for details). Red layers represent major phases of red constructed floors and clay-line pits; grey layers are rich in burnt remains; reddish brown shades are brownish layers of mixtures of clay-rich deposits and burnt remains; black horizons represent discrete burnt layers; orange layers are water-laid deposits; white striped objects are stones.



CPI 21. Trench B1. Right: detail of the area of the multiple burial of layer 14 and the overlying red clay floor of layer 13. Left: resin impregnated slab of a sample from this sequence shows successive floor constructions above the red basal one and intervening black hearth remains with some white fragments of shell.



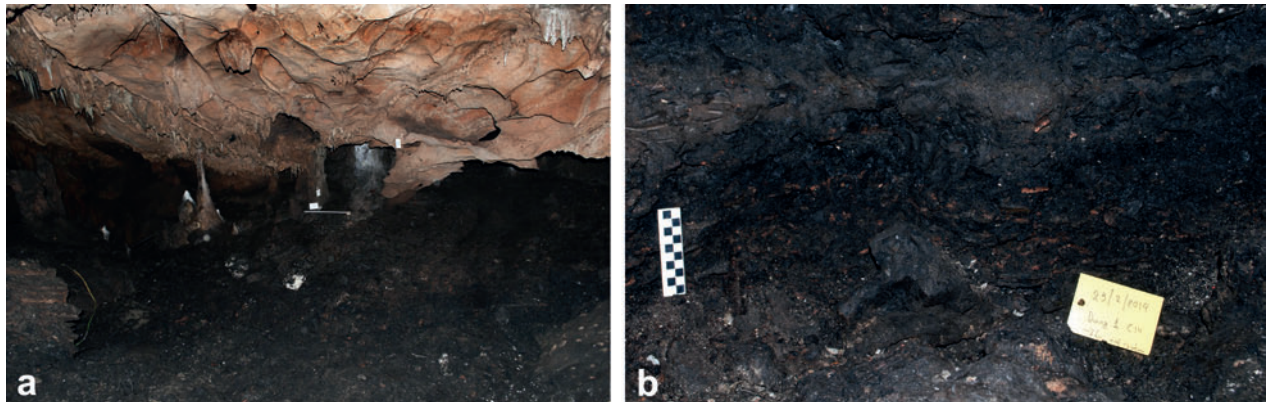
CPI 22. Impressive rounded clay-lined pits in area B2-B5. White patches on the ground represent ash remains. Note the speleothem crust on top of the small baulk on the right front view and at the rear view of the photo.



CPI 23. Petrocheilou section consisting of red clay floors and constructions and intercalated white and black hearth remains. The sequence is capped by a speleothem crust with a forest of small stalactites.



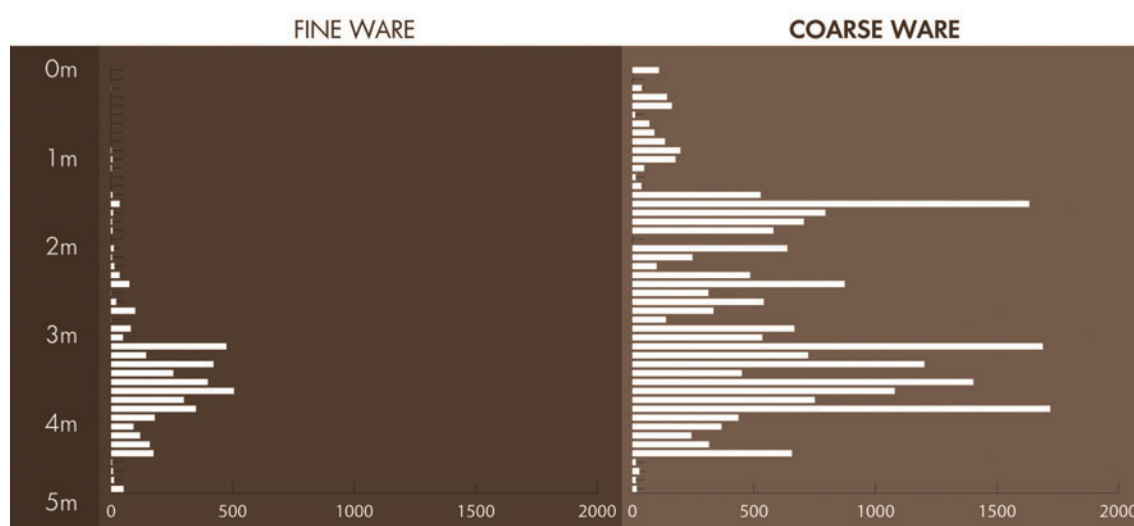
CPI 24. Area Θ (Th) 14. a): field photo of the cake-like hearth sequence in between two constructed red clay masses. The whole sequence overlies burial remains (B). The inset shows detail of the sequence, showing red clay floors (F) overlain by pottery sherds (C) and in turn by white ash (H) and charcoal remains; b): Resin-impregnated slab of the Θ 14 sequence, showing thick red clay floors (F) and thin stringers of red clay floor remains intercalated with burnt remains (H). Pottery sherds are marked with C. The bottom black layer represents burnt dung remains.



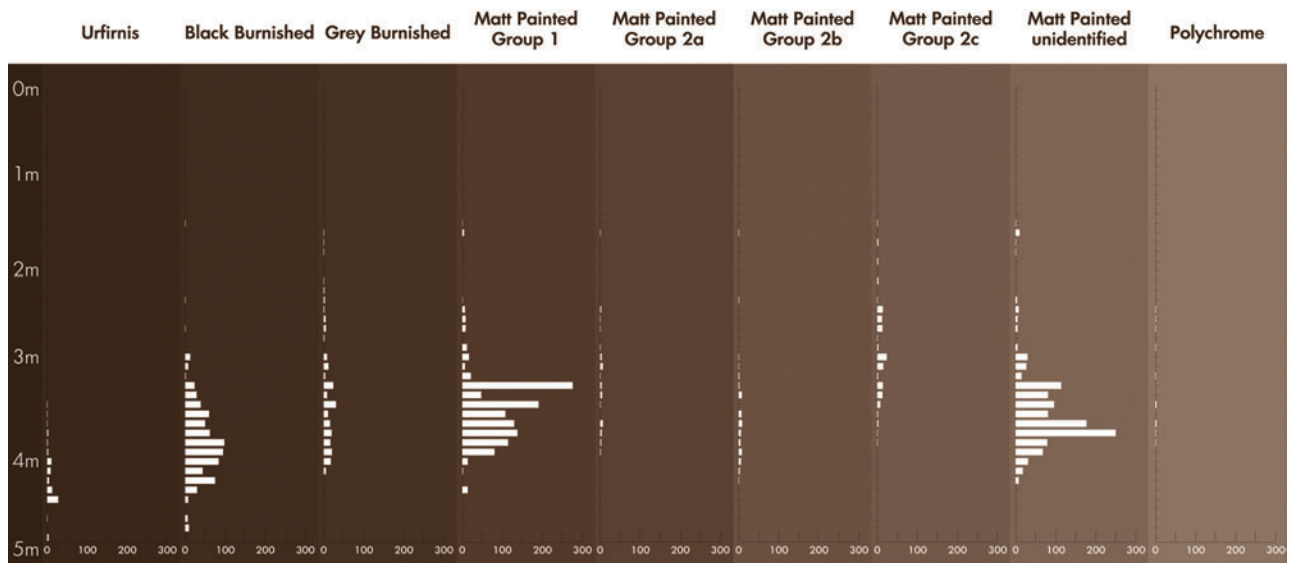
CPI 25. Images of Chamber Z. Left: the overall appearance of the black dung remains on the floor of the chamber. Right: a section of stratified burnt dung-rich remains in the bridge section (see CPI 3).



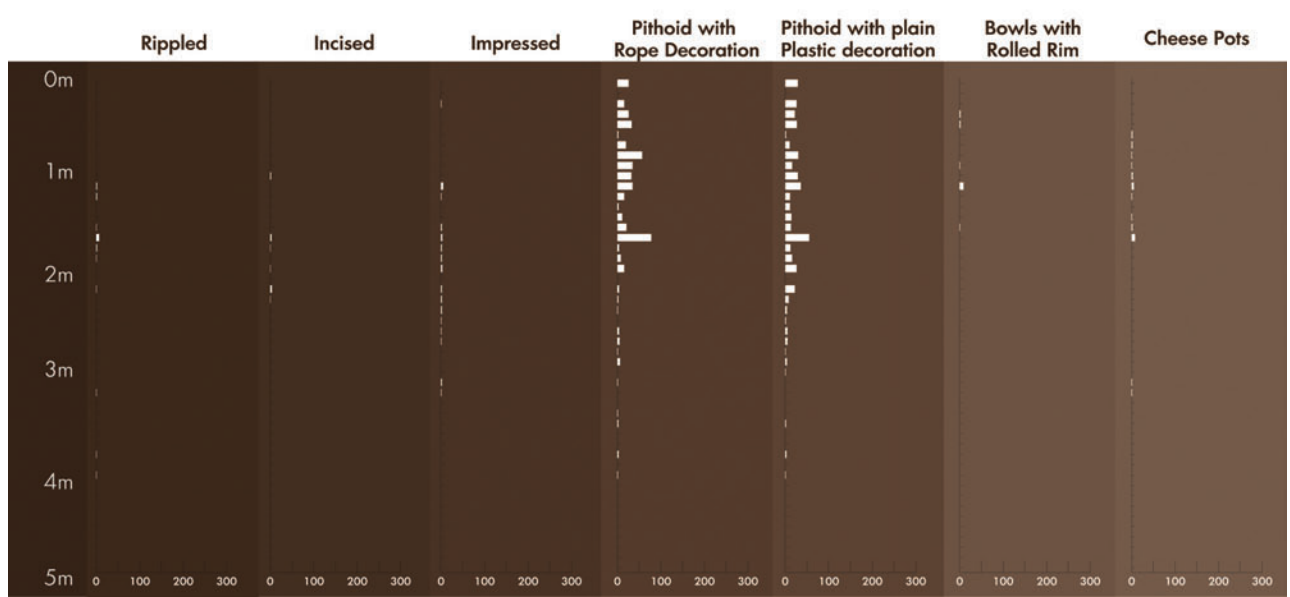
CPI 26. The relatively long and narrow gallery separating Chambers D and E.



CPI 27. Table 4.3. Quantitative evolution of fine and coarse wares in Trench B1 through time, according to find depth of sherds.



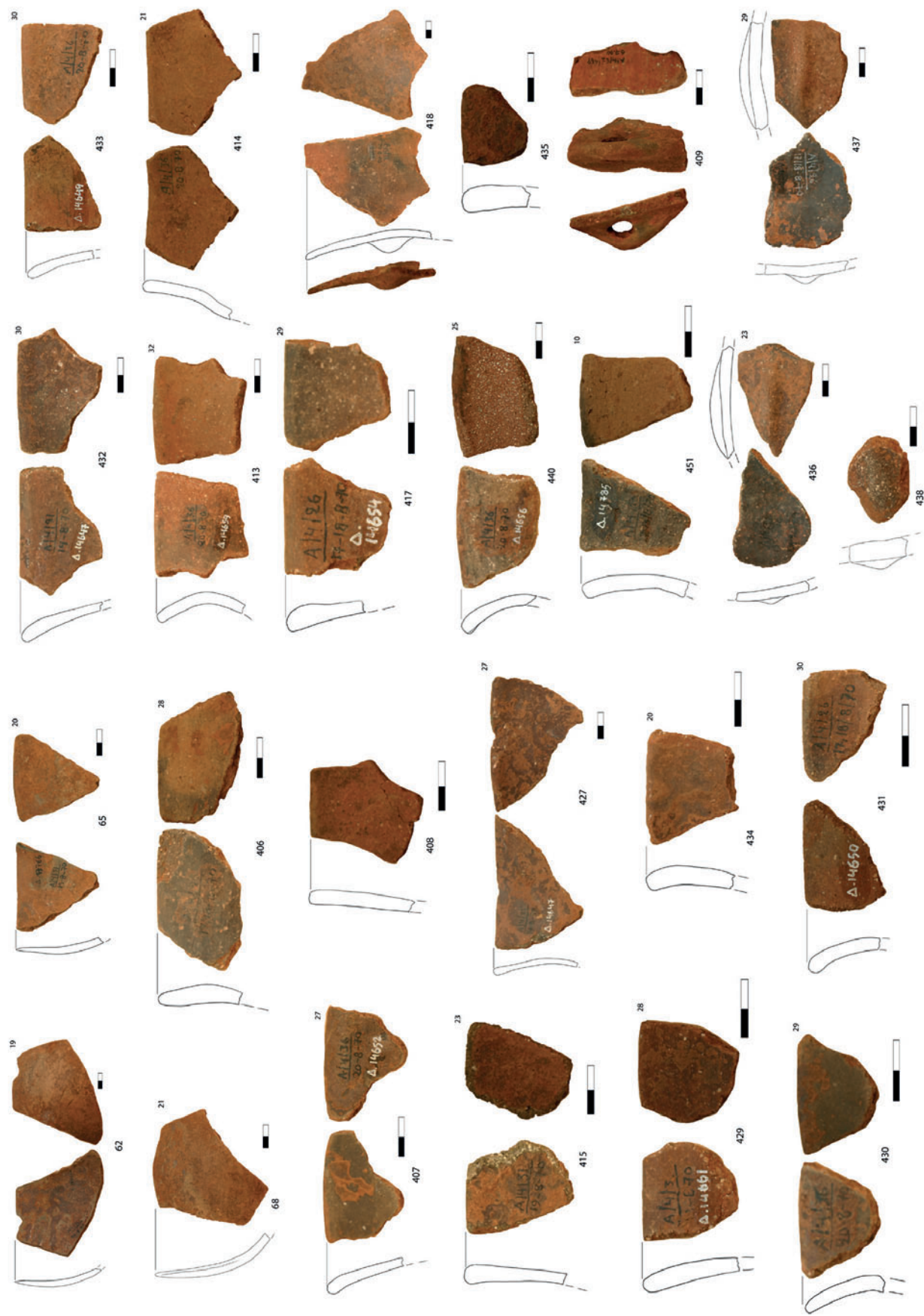
CPI 28. Table 4.1 Quantitative evolution of pottery and correlation of wares in Trench B1 through time. Categories presented according to find depth: Urfirnis, Black Burnished, Grey Burnished, Matt Painted Gr 1 (Red Group), Matt Painted Gr 2a (Cream Group with black paint), Matt Painted Group 2b (Cream Group with red paint), Matt Painted Group 2c (White-slipped Group), Matt Painted unidentified (Cream Group sherds preserving no trace of paint) and Polychrome.



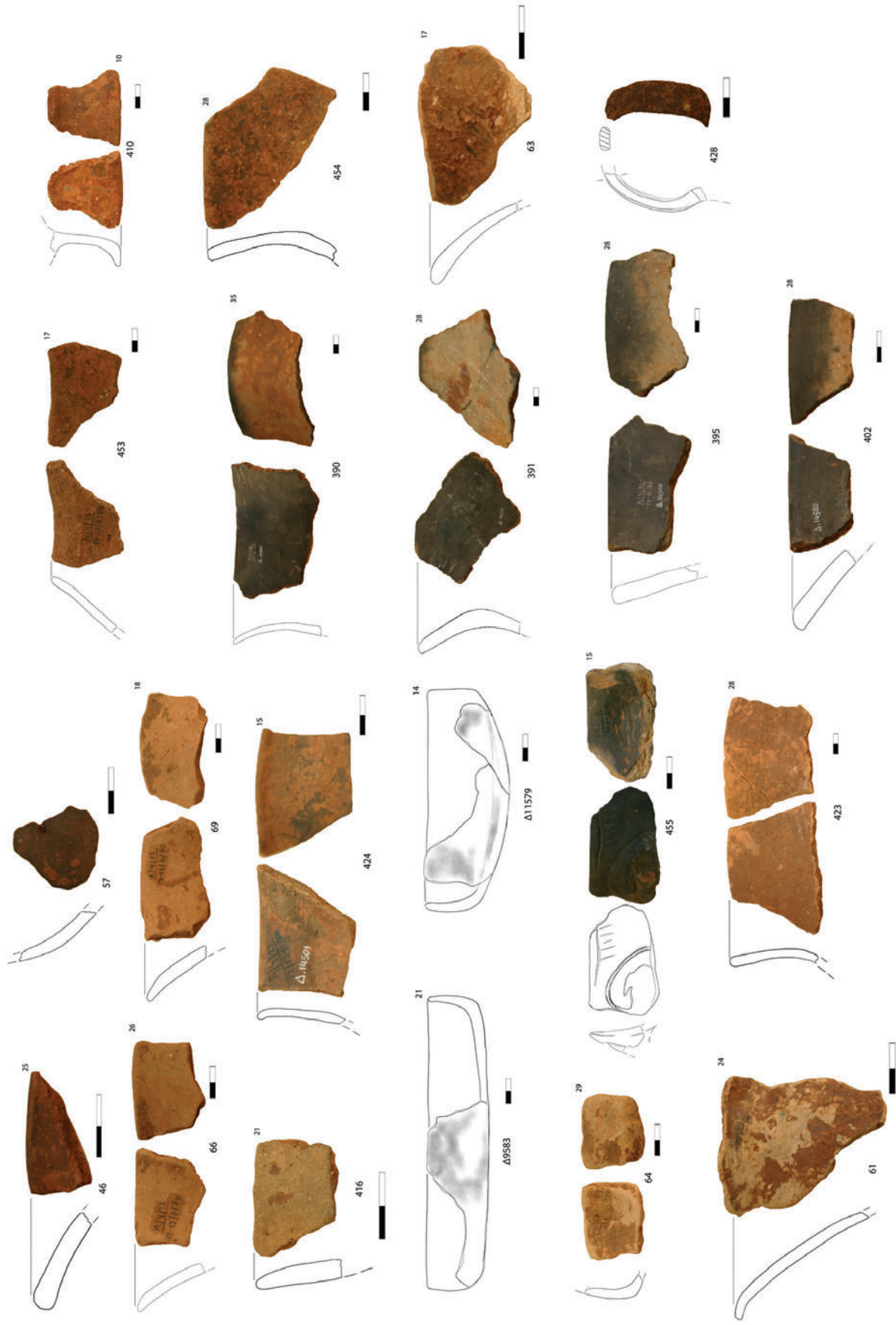
CPI 29. Table 4.2. Quantitative evolution of pottery and correlation of wares in Trench B1 through time. Categories presented according to find depth: Rippled, Incised, Impressed, Pithoid with Rope Decoration, Pithoid with plain plastic decoration, and two types of vessel: Bowls with Rolled Rim and ‘Cheese Pots’.



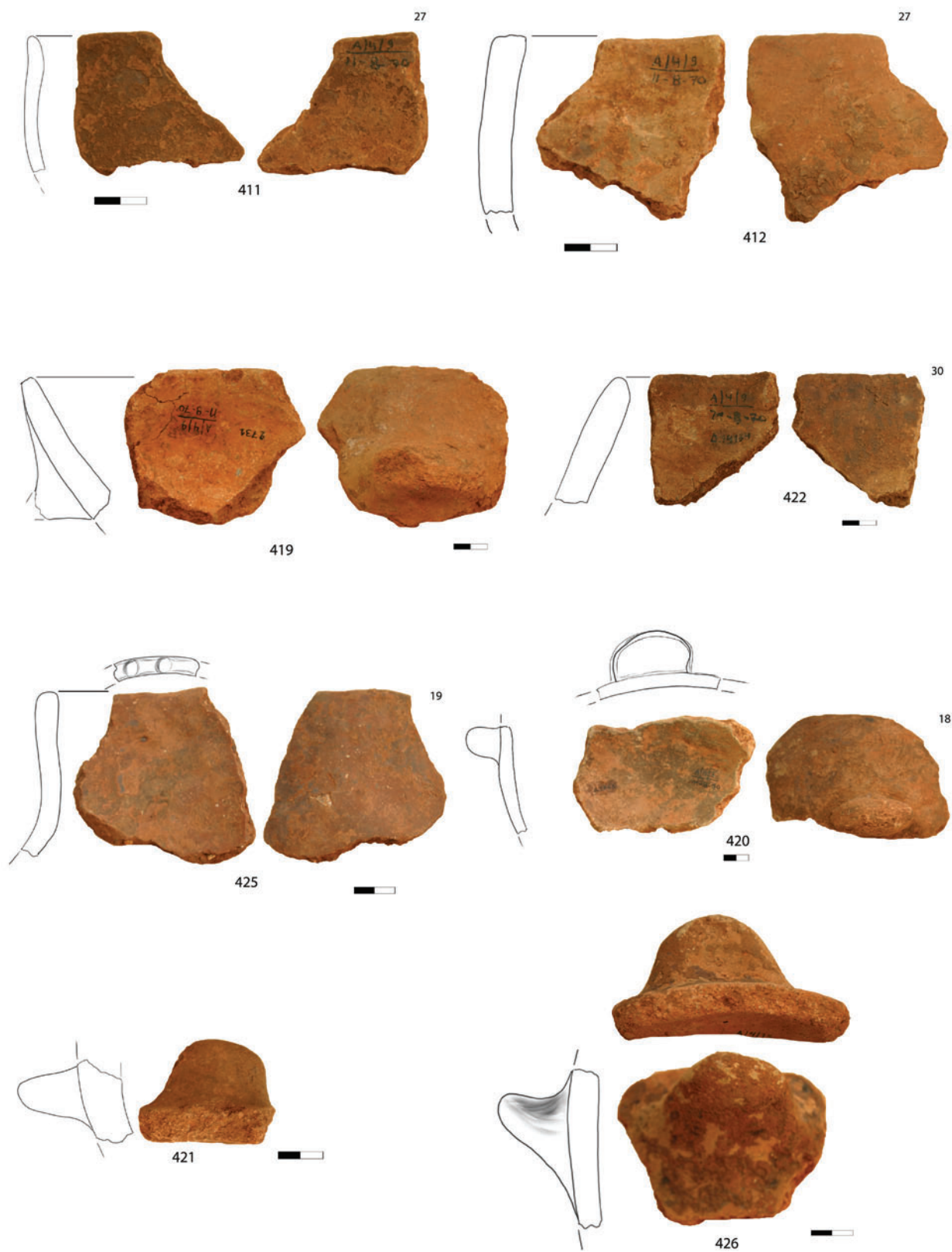
CPI 30. Geophysical map of Laconia with the location of Alepotrypa Cave in Diros Bay (edited by Vasileios Panou).



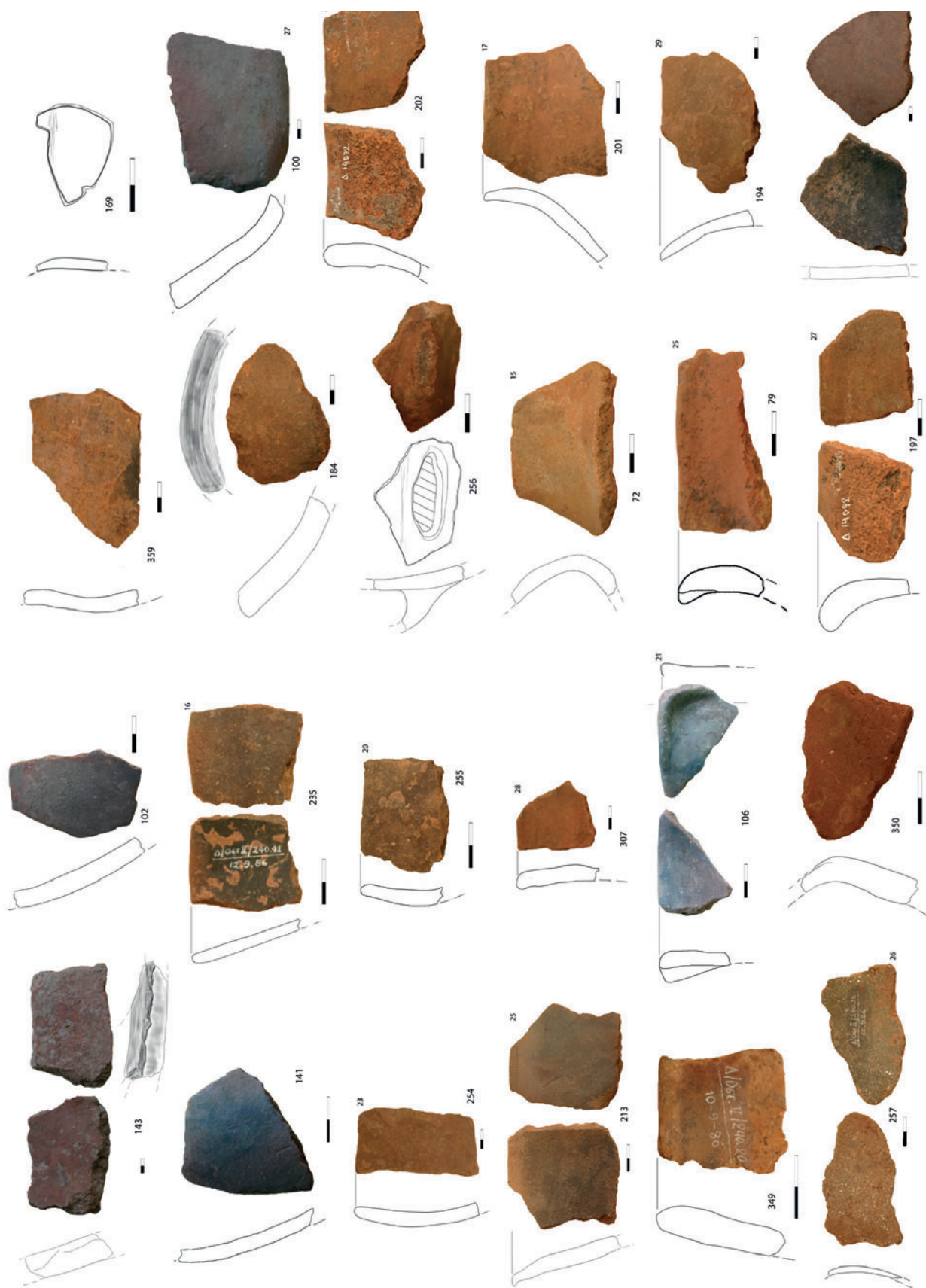
CPII 1. Ossuary 1. Early Neolithic pottery (by Anastasia Tzalla and Stella Katsarou).



CP II 2. Ossuary I. Late Neolithic pottery (by Anastasia Tzalla and Stella Katsarou).



CPII 3. Ossuary I. Final Neolithic pottery (by Anastasia Tzalla and Stella Katsarou).



CPH 4. Ossuary II. Plain monochrome ware (by Anastasia Tzalla and Stella Katsarou).



CPII 5. Θ (Th) 24 during excavation (by George Valvis).



CPII 8. Matt-painted vessels from Niche 31 (as exhibited at the Diros Museum) (by Andreas Heliakopoulos).



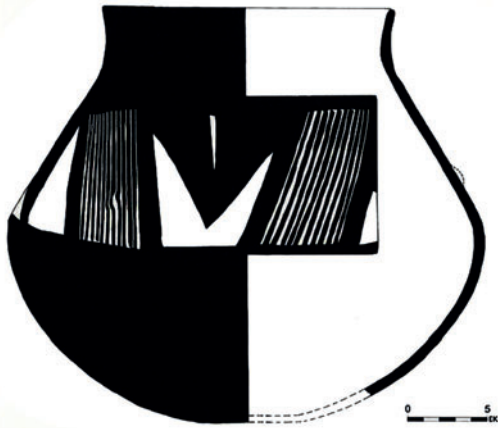
CPII 9. Polychrome sherds from a collar jar. One piece was found in the interior of Niche 31 and the other outside and in a distance from it, opposite Θ (Th) 22 (by Andreas Heliakopoulos).



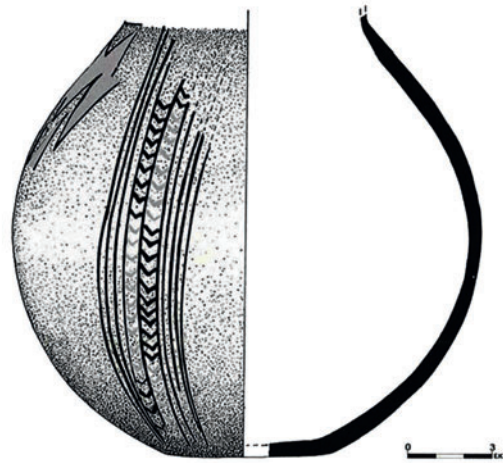
CPII 6 and 7. FN red monochrome collar jars from Niche 31 (by Andreas Heliakopoulos).



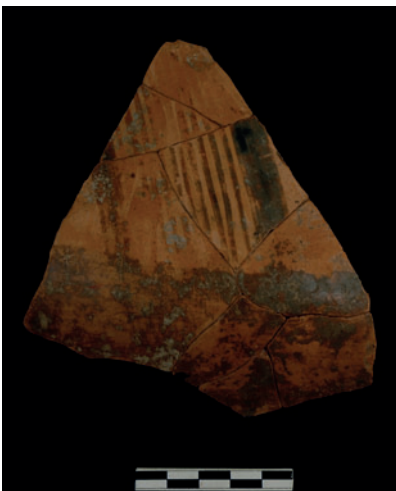
CPII 10. Pottery with red crusted decoration from Θ (Th) 24 (by Andreas Heliakopoulos).



CPII 11. MN pattern-painted Urfirnis collar jar from Z22 (after Papathanassopoulos 2011, 201, catalogue number 148).



CPII 12. Black-on-Red pottery (after Papathanassopoulos 2011, 203, cat. no. 150).



CPII 13. Part of the patterned Urfirnis collar-jar of CPII 11 from Θ (Th) 22, but found scattered inside the nearby Z22a (by Andreas Heliakopoulos).



CPII 14. Polychrome pottery (by Andreas Heliakopoulos).



CPH 15. Simple relief bands (decoration type A1).

CPH 16. Consecutive relief bands (decoration type A2).

CPH 17. Consecutive relief bands (decoration type A2).

CPH 18. Systems of relief bands (decoration type A3).

CPH 19. Systems of relief bands (decoration type A3).

CPH 20. Systems of relief bands (decoration type A3).

CPH 21. Relief bands with rounded marks or fingerprints (decoration type B1).

CPH 22. Consecutive relief bands with rounded marks or fingerprints (decoration type B2).



CPII 23. Consecutive relief bands with rounded marks or fingerprints (decoration type B2).

CPII 24. Systems of relief bands with rounded marks or fingerprints (decoration type B3).

CPII 25. Systems of relief bands with rounded marks or fingerprints (decoration type B3).

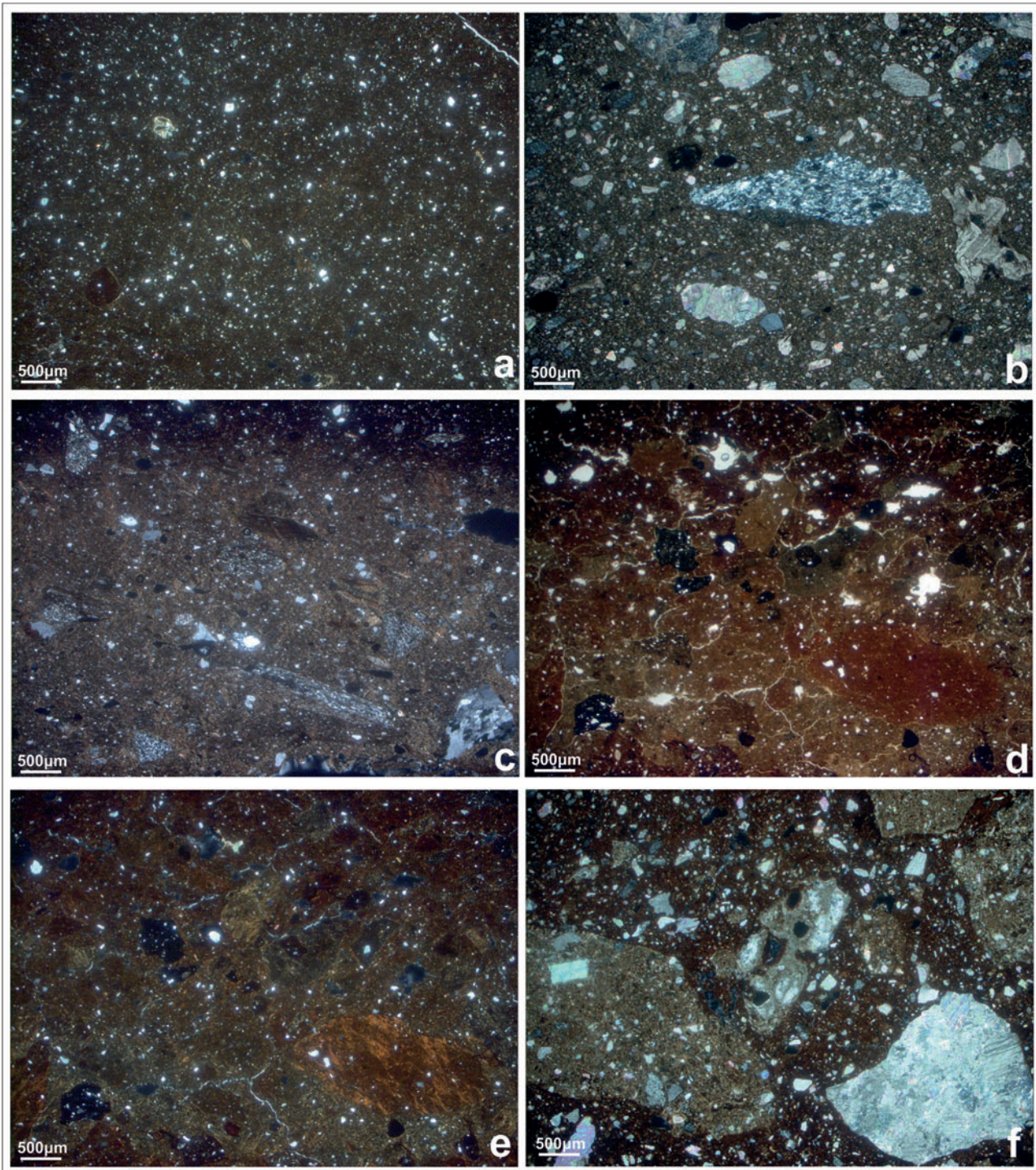
CPII 26. Systems of relief bands with rounded marks or fingerprints (decoration type B3).

CPII 27. Systems of relief bands with rounded marks or fingerprints (decoration type B3).

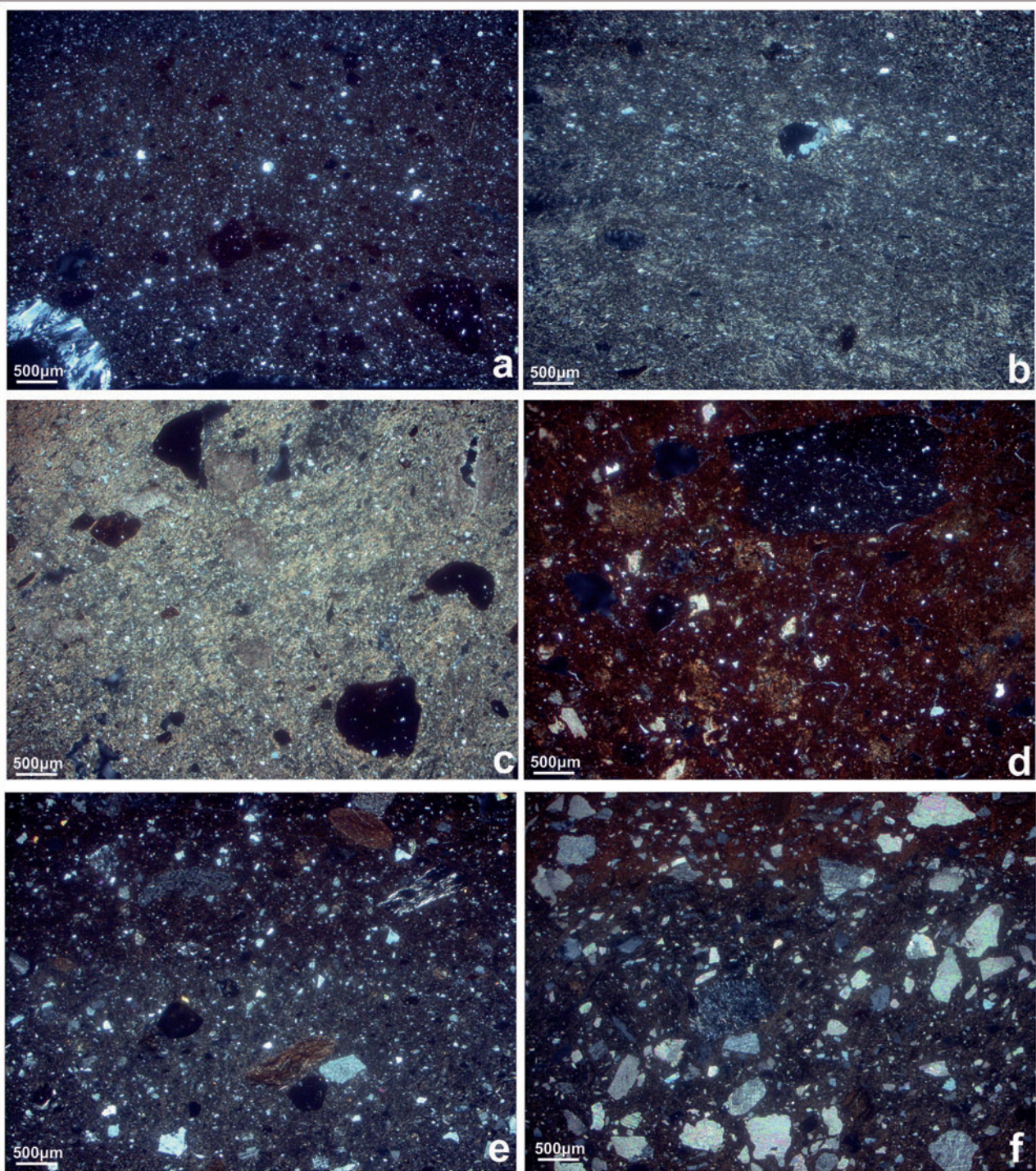
CPII 28. Systems of relief bands with incisions (decoration type B4).

CPII 29. Systems of relief bands with incisions (decoration type B4).

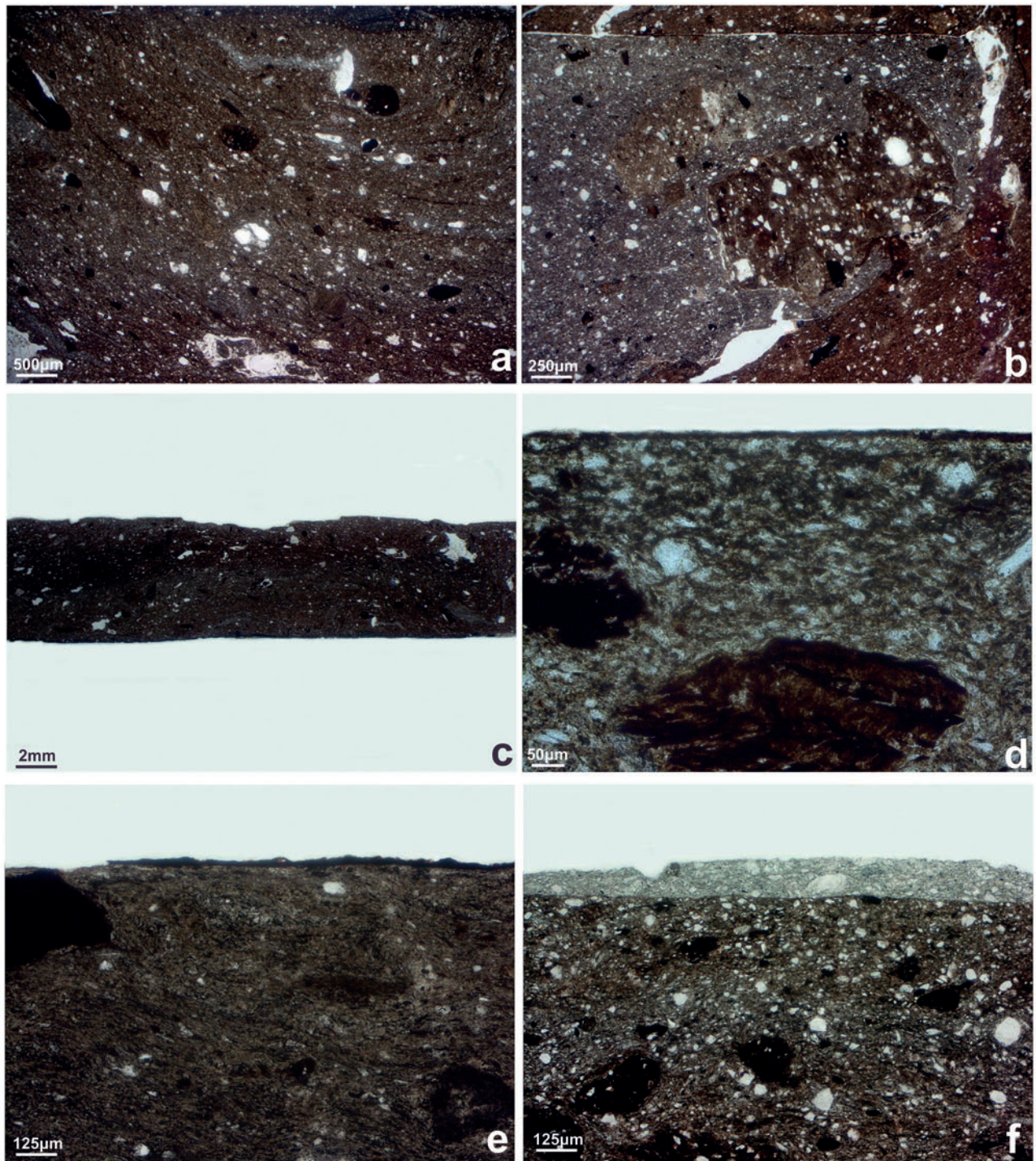
CPII 30. Systems of relief bands with incisions (decoration type B4).



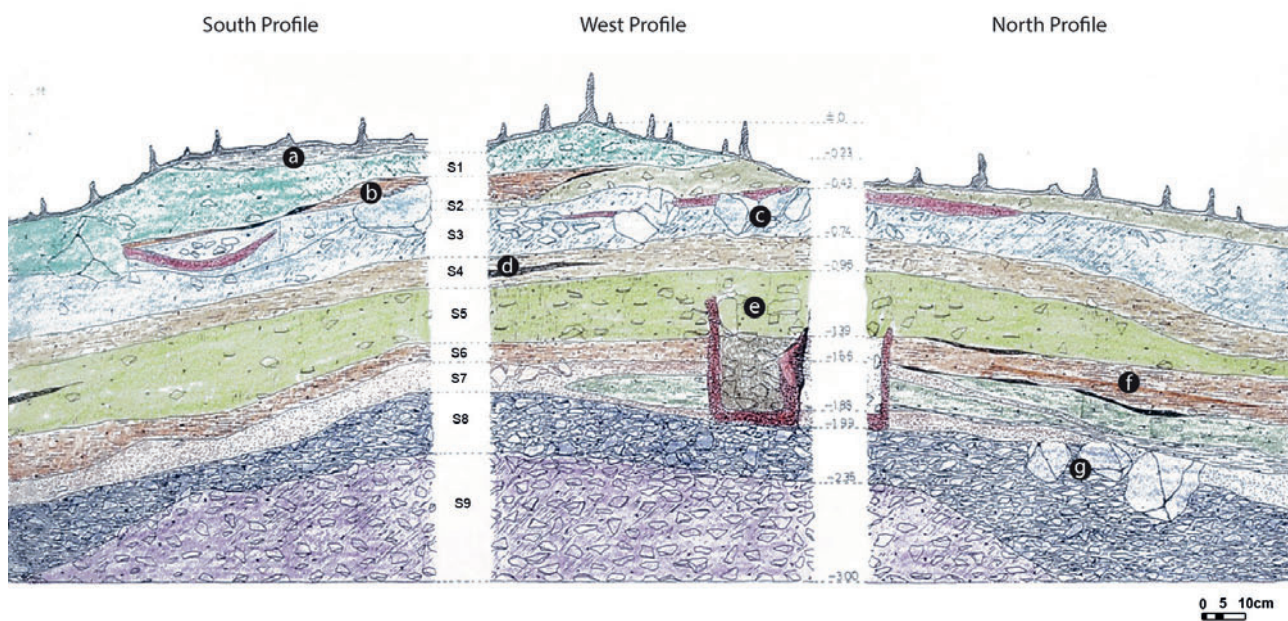
CPII 31. Microphotographs of Alepotrypa Cave raw materials and fabric groups samples. a. Raw material sample ACGS1; b. Raw material sample ACGS2; c. Phyllite, quartz-rich metamorphic and shale fabric (FG1: AC47); d and e. Tcfs/Clay pellets and grog fabric (FG2: AC9); f. Calcite fabric (FG3: AC2) (all microphotographs in XPL, except d. in PPL).



CPII 32. Microphotographs of Alepotrypa Cave fabric groups samples. a. Fine quartz-rich metamorphic, phyllite and clay pellets fabric (FG4: AC42); b. Fine quartz fabric (FG5: AC42); c. Calcareous and clay pellets fabric (FG6: AC28); d. Calcite and grog fabric (FG7: AC26); e. Quartz-rich metamorphic, phyllite and altered igneous fabric (LFG1: AC31); f. Calcite and quartz-rich metamorphic fabric (LFG2: AC55) (all microphotographs in XPL).



CPII 33. Technological practices as depicted in thin section. a. Clay mix (AC44); b. Grog fragment, possibly bearing second generation grog (AC33); c. Relic coil (AC44), d. Red Urfirnis ware, iron-rich slip (AC46); e. Matt-painted ware, manganese-rich slip (AC38); f. Matt-painted ware, calcareous slip (AC42) (all microphotographs in PPL).



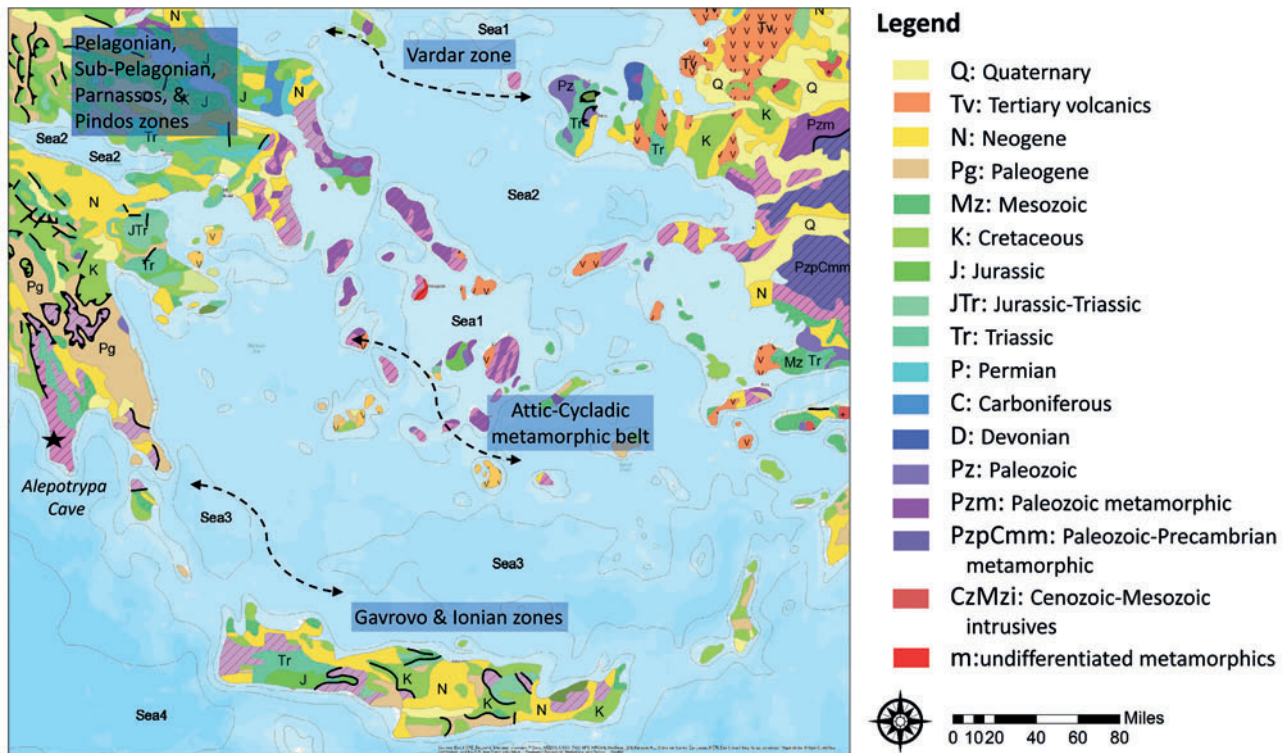
CPII 34. Stratigraphy I: the nine layers (S1-S9) (Papathanassopoulos 1971, 20). The various structures and deposits are marked a–g.



CPII 35. Siliceous raw materials at Alepotrypa Cave and white patinated flints.



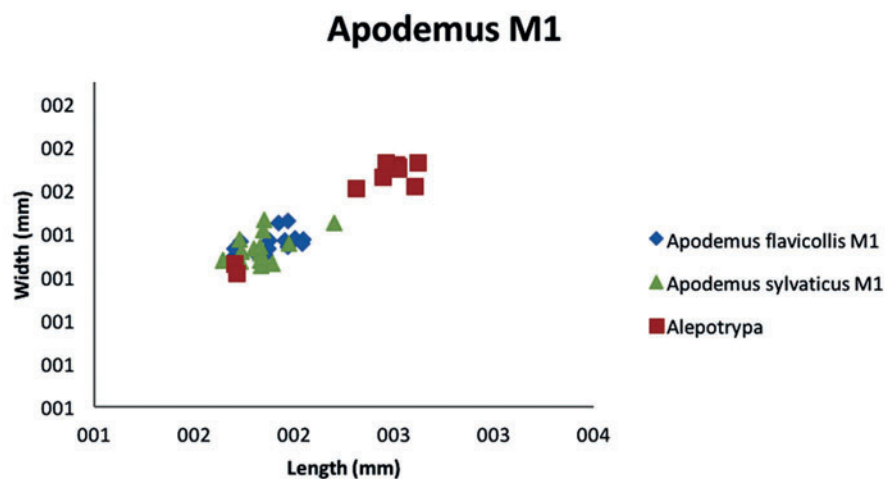
- CPII 36. Red deer proximal metacarpus sawn off from its shaft from Chamber A (Early Neolithic) (by Angelos Hadjikoumis).
 CPII 37. Pointed tools made of sheep/goat distal tibia (left) and distal metapodium (right), unknown context (by Angelos Hadjikoumis).
 CPII 38. Large pointed tools made of red deer metapodia, unknown context (by Angelos Hadjikoumis).
 CPII 39. Fox canine pendant from Chamber Z (Early-Final Neolithic) (by Angelos Hadjikoumis).



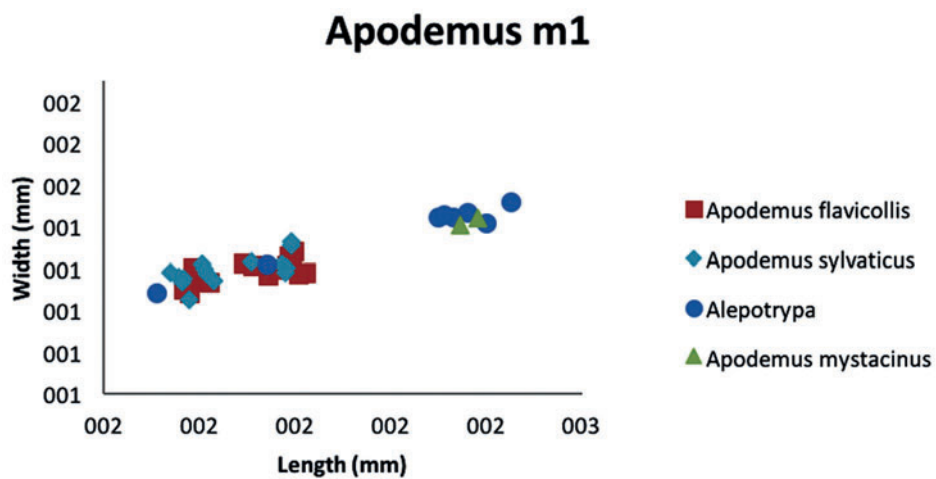
CPII 40. Geological map of the Aegean.



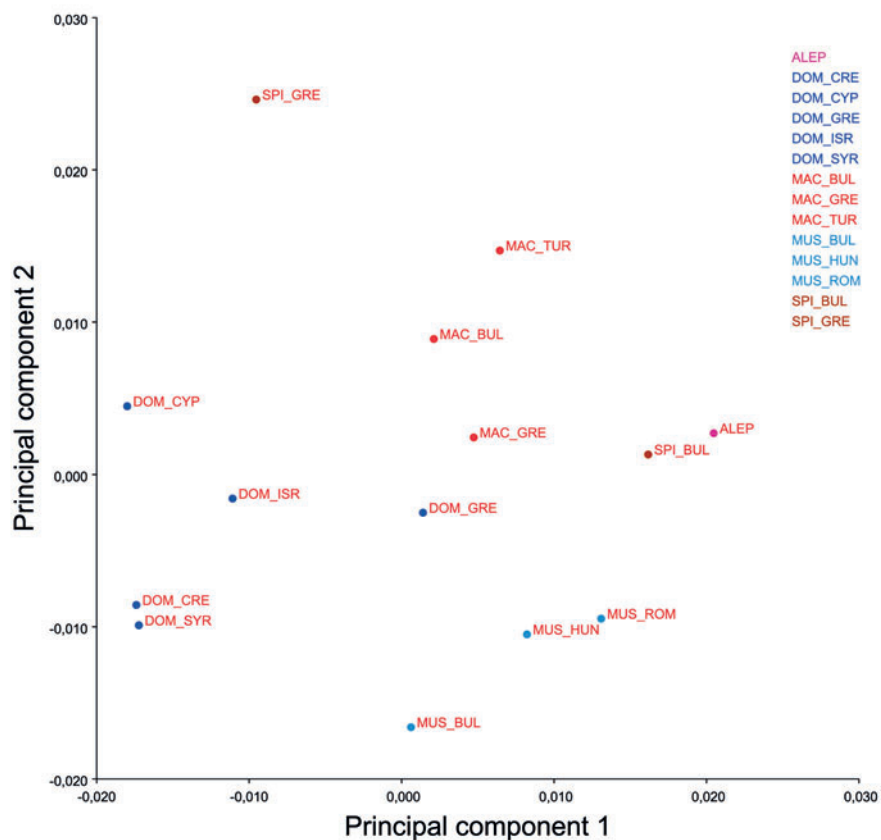
CPII 41. View of the Diros Bay – cave arrowed (by Rebecca Seifried).



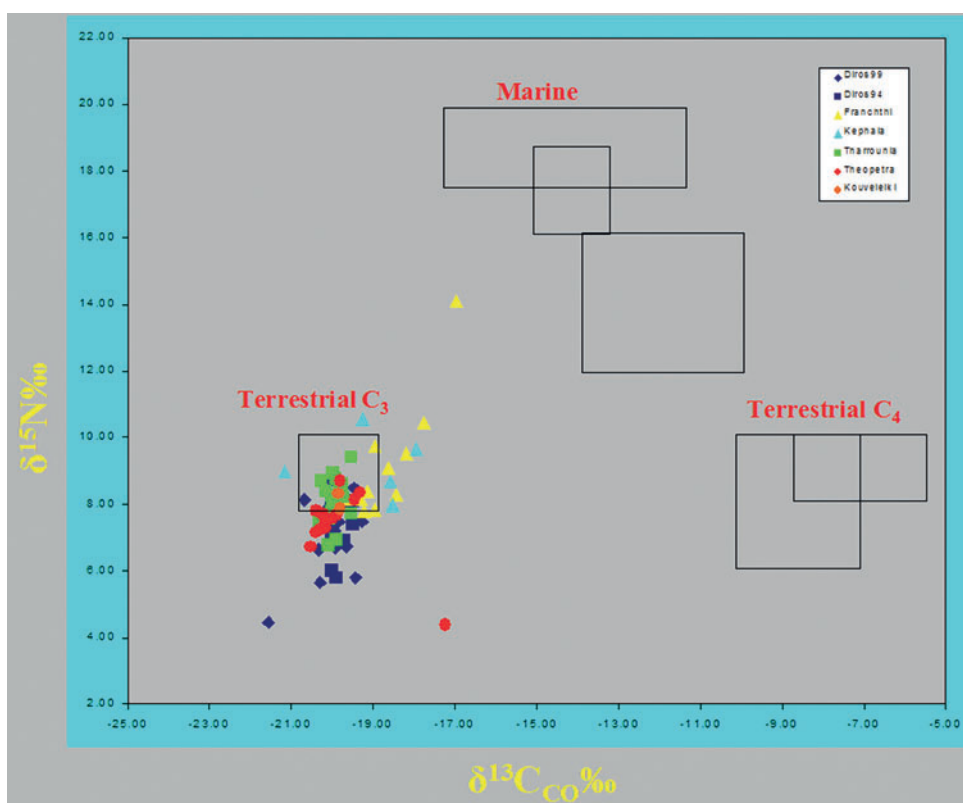
CPII 42. First upper molar measurements of *Apodemus* sp.



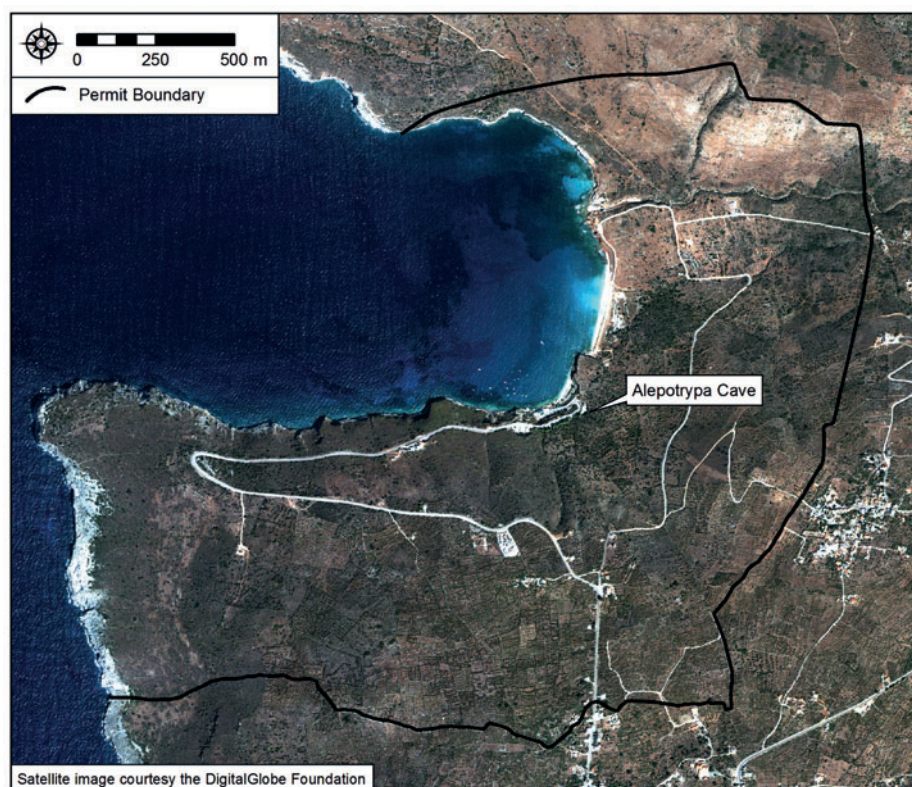
CPII 43. First lower molar measurements of *Apodemus* sp.



CPII 44. Principal Component Analysis of the mean molar shape differences between the *Mus* sp. from *Alepotrypa* and modern comparative *Mus* sp.: wild mice (*M. macedonicus*, *M. spilegous*) and the two house mouse subspecies (*M.m.musculus*, *M.m.domesticus*)



CPII 45. Palaeodietary reconstruction from carbon and nitrogen stable isotope analysis.



CPII 46. Overview of the study region showing the entrance to Alepotrypa Cave.



Alepotrypa Cave at Diros Bay, Lakonia, Greece, is a massive karstic formation of consecutive chambers ending at a lake. The cave was excavated by G. Papathanassopoulos from 1970 to 2006. In conjunction with the surrounding area, it was used as a complementary habitation area, burial site, and place for ceremonial activity during the Neolithic c 6000 to 3200 BC.

As a sealed, single-component, archaeological site, the Neolithic settlement complex of Alepotrypa Cave is one of the richest sites in Greece and Europe in terms of number of artifacts, preservation of biological materials, volume of undisturbed deposits, and horizontal exposure of archaeological surfaces of past human activity and this publication is an important contribution to ongoing archaeological research of the Neolithic Age in Greece in particular, but also in Anatolia, the Balkans and Europe in general.

This edited volume offers a full scholarly interdisciplinary study and interpretation of the results of approximately 40 years of excavation and analysis. It includes numerous chemical analyses and a much needed long series of radiocarbon dates, the corresponding microstratigraphic, stratigraphic and ceramic sequence, the human burials, stone and bone tools, faunal and floral remains, isotopic analyses, specific locations of human activities and ceremonies inside the cave, as well as a site description and the history of the excavation conducted by G. Papathanassopoulos.

ANASTASIA PAPATHANASIOU is an archaeologist with the Greek Ministry of Culture in the Ephorate of Paleoanthropology and Speleology. Her research interests focus on the areas of bioarchaeology, paleopathology, paleodiet, stable isotope analysis, mortuary practices, and prehistoric archaeology. She conducts physical anthropological and archaeological research in Neolithic and Bronze Age sites in Greece.

WILLIAM A. PARKINSON is Curator and Professor of Anthropology at the Field Museum and the University of Illinois at Chicago. His research interests focus on the evolution of agricultural villages in the European Neolithic and Bronze Age. He conducts collaborative archaeological research in Hungary on the Körös Regional Archaeological Project, and in Greece on The Diros Project.

DANIEL J. PULLEN is Professor and Chair of the Department of Classics at Florida State University. His research interests are in the Neolithic and Bronze Age of the Aegean, particularly landscape archaeology, architecture, and ceramic analysis. He is co-director of the Saronic Harbors Archaeological Research Project, where he is focusing on the fortified Mycenaean harbor site of Kalamianos.

MICHAEL L. GALATY is Professor of Anthropology at the University of Michigan, where he is Director of the Museum of Anthropological Archaeology. He conducts field research in Albania and Greece, with a focus on the origins of social complexity.

PANAGIOTIS (TAKIS) KARKANAS is presently the Director of the Malcolm H. Wiener Laboratory for Archaeological Science in the American School of Classical Studies at Athens. His research interests encompass all aspects of geoarchaeology including site-formation processes and palaeoenvironmental reconstructions.